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WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOLUME V

November 1928—September 1929

STANFORD UNIVERSITY
CALIFORNIA

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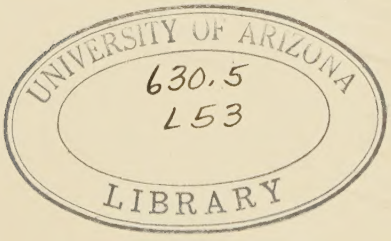

Printed in the United States of America

FOOD RESEARCH INSTITUTE
STANFORD UNIVERSITY, CALIFORNIA

WHEAT STUDIES, VOL. V, 1928-29

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ERRORS IN VOLUME V*

Page 49, Table 1: *delete* from footnote *b* "and is always better than feed, rejected, or condemned wheat."

Page 58, first column, line 9: *for* production, *read* consumption.

Page 133, first column, line 11: *for* "important requirements," *read* "import requirements."

Page 114, Table 1: U.S. average 1923–27, *for* 842, *read* 822.

Page 146, Table X: Australia—Total disappearance 1927–28, *for* 151, *read* 158.

* In general, no attempt has been made to revise figures or statements to accord with later information, or to correct minor typographical errors.

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WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 1 NOVEMBER 1928

FORECASTING WHEAT YIELDS FROM THE WEATHER

ELEMENTS OF AN UNSOLVED PROBLEM

CUSTOMARY methods of forecasting crop yields are based on the exercise of judgment and are subject to errors inherent in judgments, especially to bias. Hence methods involving the least possible exercise of judgment are needed, if only as checks upon current methods.

Forecasting yields from the weather would satisfy this need. Proposed methods assume that a given crop plant in a given region always reacts in the same way to a given kind of weather. Mathematical formulae have been developed to predict crops in a given year from weather and crop data of earlier years, and weather data of the year in question. Sometimes such forecasts are reasonably good, sometimes not. They would be better if data for past crops were not often inaccurate; if weather data, though reasonably exact, did not sometimes lack important weather factors; and if more were known of the laws of growth and of the influence of environmental factors on crop formation.

To remedy these deficiencies, crop yield statistics and weather records must be improved, and much scientific research upon the laws of plant growth must be conducted. Investigations by physiologists designed especially to determine at what stages of the crop plant's growth the weather exerts the greatest influence, and why, will prove particularly important. If these various gaps in knowledge are filled—and there is no reason why they cannot be—forecasting yields from the weather should become a valuable tool for agricultural statisticians. In all probability the process must always depend in part upon statistical analysis. Experimental work promises to make its greatest contributions toward the problems of forecasting by furnishing improved bases for statistical analysis.

STANFORD UNIVERSITY, CALIFORNIA

November 1928

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

The central feature of the series is a periodic analysis of the world wheat situation, with special reference to the outlook for supplies, requirements, trade, and prices. Each volume includes a comprehensive review of the preceding crop year, and three surveys of current developments at intervals of about four months. These issues contain a careful selection of relevant statistical material, presented in detail in appendix tables for reference purposes, and in summary form in text tables and charts.

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Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.
Published by Stanford University for the Food Research Institute.

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FOOD RESEARCH INSTITUTE

STANFORD UNIVERSITY, CALIFORNIA

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The Food Research Institute was established at Stanford University in 1921 jointly by the Carnegie Corporation of New York and the Trustees of Leland Stanford Junior University, for research in the production, distribution, and consumption of food.

FORECASTING WHEAT YIELDS FROM THE WEATHER

ELEMENTS OF AN UNSOLVED PROBLEM

I. PRELIMINARY CONSIDERATIONS

Man's progress, at least materially, has been won by achieving ever greater independence of his surroundings. With advancing material civilization he has become less and less subject to injury from the numerous factors that tend to hamper his development. Some of these, such as diseases and predatory animals, he has succeeded, more or less perfectly, in controlling or eliminating. Others, like climate or the weather, he is unable to control, but to them he has succeeded in making adaptations so as to nullify many of their adverse effects. To this end he has developed housing, clothing, and heating, and also special forms of agriculture. Crop plants and domesticated animals have been adapted to different climates. Different soil conditions have been met by different forms of tillage and by the use of fertilizers. Nevertheless, in spite of all that has been achieved in these ways, agricultural production remains extremely variable and hazardous, chiefly because of fluctuations in the weather.

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Having been unable as yet to overcome to any great degree the hazards of the weather, man has turned his attention to forecasting its probable effects, for it is obvious that next to eliminating or controlling hazards the best procedure is to foresee them. To be forewarned is to be forearmed. If it is possible to foresee a crop failure, or even a short crop, steps may be taken at least to minimize the evil effects.

Famines were perhaps the evil effects that man first attempted to minimize by forecasting crops. To mitigate their horrors men must from the earliest times have endeavored to forecast harvests. Except here and there, this is no longer an important object of crop forecasting, for the excellence of transportation facilities in the modern world permits the shipment of sufficient volumes of food into deficiency areas. If famines nevertheless occur, it is most frequently because the victims lack sufficient purchasing power. Moreover, crop forecasts are of limited use in predicting famines, partly because it is not yet possible to make them far enough in advance of the harvest, but principally because it is especially difficult to forecast more or less complete crop failures. It is to crop failures that famines are usually due. Such failures are commonly the consequence of quite abnormal conditions or even catastrophes, such as hurricanes, hail, unseasonable frosts, prolonged drought, and the like. These can hardly be foreseen until they happen. One can, however, estimate the probability of the occurrence of these catastrophes by studying the weather records of the past. Such knowledge enables governments, with a minimum of waste, to accumulate in times of plenty the resources for famine relief. In ancient times, this took the form of the accumulation of reserve stores of food; in modern times, it takes the form of the accumulation of money reserves or credits to be used for the work of relief or for the prosecution of public works to enable citizens to earn the money with which to purchase imported food.

Another method of minimizing the evil effects of bad harvests, which has begun to be practiced only in recent years, is to distribute the risk by insuring the crop. To

any reasonably perfect system of crop insurance forecasts of yields are basic. At the present time crop insurance has been limited largely to the effects of such catastrophes as hail, hurricanes, or unseasonable frosts, involving the more or less complete destruction of crops. In such cases, the underwriters are interested primarily in the comparatively simple actuarial problem of determining the probability of such catastrophes and in adjusting to the probabilities the premiums demanded for assuming the risk. When, however, injury rather than complete destruction of the crop is involved, forecasting the yield becomes fundamental to any scheme of insurance. In such instances, the adjuster must determine the extent of the damage done by the hail, the hurricane, or the frost, as the case may be. To do so, he must first form some estimate of what the crop would have been had there been no hail, no hurricane, no frost. This involves estimating the yields that would have prevailed under the weather conditions in that season had no catastrophe occurred. Since, as we shall see, the methods of forecasting crop yields are as yet quite imperfect, most plans of crop insurance recently proposed have been based not on the actual amount of damage done but rather upon the investment of the farmer in the crop or upon the ten-year-average crop yield. Neither of these plans is, of course, as equitable as that of basing the contract upon actual damage, the plan now almost universally adopted in the insurance of property against loss from fire and the like.

More important to modern states than the forecasting of famines is the forecasting of crops in connection with the preparation of budgets, for crops are important sources of the national income, which in the last analysis determines the capacity of a large part of the people to pay taxes. Crop forecasting becomes especially important when the crop itself is taxed or when, as is the practice on some of the sugar islands, the tax upon the export of agricultural produce is an important source of revenue. Forecasting the crop is furthermore important in predicting a nation's balance of trade. If the nation produces a surplus, the probable size of the exportable fraction must be known in order that its value may be placed on the credit side of the balance sheet. If the nation produces only a fraction of its own requirements, the volume of imports that will be required, the value of which must be placed on the debit side, will be determined in large measure by the size of the domestic crop. Finally, crop forecasting at the earliest possible moment is, obviously, important also for those countries that subsidize or propose to subsidize agriculture directly or to protect the farmer more indirectly by some such plan as the equalization fee of the McNary-Haugen bill, government-operated pools, special freight tariffs, government crop insurance, and the like.

To private citizens and to corporations the forecasting of harvests is of manifest importance. If they are farmers, they will want to take into consideration such forecasts in planning their harvesting and marketing operations. If they are dealers in the crop, the forecasts directly affect their current policies and plans, for crop prospects are of very great influence in determining the course of prices. If they are merchants of other sorts, they will want to use forecasts in determining the probable future purchasing power of the different elements of the population that consume their goods or services. Manufacturers using agricultural raw materials, for example millers or cotton spinners, will use forecasts to learn how much raw material is likely to be available. Railroad executives will use them to make preparations for the transportation of the crops. Bankers will be able to employ them in forecasting future economic conditions in general as well as in preparing to finance the movement of crops.

It is obvious, then, that accurate forecasting of crops is a matter of great importance to the economic life of any nation. If it were possible to make accurate forecasts well in advance of harvest, multifarious adjustments would be made with far greater ease than at present, and there would be far greater opportunities to moderate the movements of agricultural prices and production, and to minimize the violent fluctuations in economic conditions which hitherto have been found unavoidable.

Common Methods of Crop Forecasting

Crop forecasting of a sort has been practiced since time immemorial. Experienced men have always given their opinion on the probable crop outturn of a field or a district; and such opinions, modified in certain ways, still form the basis of the principal methods of crop estimating now in use. Such forecasts involve two quantities: the area planted to the crop, and the yield per unit of area. The prospective volume of the crop is computed by multiplying one quantity by the other. The farmer who forecasts the outturn of a given field either knows its area or estimates it; he estimates the probable yield per unit area and, consciously or subconsciously, makes the computation.

Now the two factors, acreage and yield, present quite different problems in estimating. Acreage is static; ordinarily it is constant after the end of the planting season.[1] Where acreage in a particular crop is abandoned, an allowance for this reduction can be made. The acreage to be harvested may, therefore, be determined in advance of the harvest with reasonable exactness by taking a census, i.e., by actual count or enumeration.[2] Few countries, however, do this because of the great expense[3] and because it ordinarily takes so long that the results are obtained too late for forecasting purposes. Most countries are compelled to resort to an enumeration of representative samples of the total area, to reports furnished by experienced farmers, or to other methods of estimating.[4] Errors in estimates of acreage are by no means negligible, and they may be cumulative over a period of years.[5] As a rule, however, the variations in acreage from year to year are much smaller, and more closely calculated some months before harvest, than is the case with yields per acre.

Unlike the acreage, the yield per acre is not fixed but highly variable. It cannot be determined by census methods in advance of the harvest, for one cannot enumerate or measure what does not yet exist. One can take a census and make an enumeration only at the time of harvest or thereafter. Few countries take such a census because of the expense; hence, official estimates of crops actually harvested commonly rest upon a census of a more or less representative sample, on the reports of experienced farmers, and on supplemental methods of estimating. The resulting data are by no means perfect, and even the comprehensive census reports of harvested crops, when they are taken, are subject to special kinds of error. Such defects as these figures contain constitute an often-unappreciated weakness in statistical attempts to derive forecasting formulas from past yields. Obviously, however, such estimates after harvest afford no substitute for the forecasts of crops before harvest.

The almost universal method of forecasting yields is to gather the opinions of a large number of experienced agriculturists and to form some sort of composite of the opinions so gathered. This may be termed

[1] However, a portion of the acreage of certain crops in certain regions may be abandoned on account of destruction of or serious damage to the crop by bad weather, and then sown to some other crop or left fallow. Thus in the hard-winter-wheat belt of the United States a variable portion of the acreage sown is winterkilled. This land may be plowed up in the spring and sown to corn (maize) or other spring crops.

[2] For a discussion of some of the sources of error in the taking of a census of acreage, see L. G. Powers, "Degree of Accuracy in Census Statistics of Agriculture," *Publications of the American Statistical Association*, 1910–11, XII, No. 93.

[3] The United States Secretary of Agriculture stated in 1920 that the entire cost of the Bureau of Crop Estimates for furnishing information (60 crops, 6 classes of live stock) was at that time about the same as the cost of the cotton-ginning reports of the Bureau of the Census.—*Weekly News Letter of the Department of Agriculture*, June 16, 1920, VII, 5 f.

[4] In this connection, it is of interest to note that weather factors may sometimes be used. Thus in some regions the acreage of winter wheat depends in some measure upon autumn rainfall. If it is so heavy that the number of days when the ground is in condition for plowing is small, acreage is reduced. (Cf. R. H. Hooker, "Correlation of the Weather and Crops," *Journal of the Royal Statistical Society*, 1907, LXX, 1 ff.) Another example is the effect of winterkilling cited above. Still another example is found in regions where, if possible, two crops per annum are grown, as in India. The time of maturity and the character of the summer crop, which depend upon the summer weather, determine the acreage of winter crops it is possible to put in. (Cf. Conrad P. Wright *et al.*, "India as a Producer and Exporter of Wheat," Wheat Studies, 1927, III, 352 ff.; and S. M. Jacob, "Correlation of Rainfall and the Succeeding Crops with Special Reference to the Punjab," *Memoirs of the Indian Meteorological Department*, 1916, XXI, pt. xiv, 131 ff.

[5] Cf. Holbrook Working, "Wheat Acreage and Production in the United States since 1866: A Revision of Official Estimates," Wheat Studies, 1926, II, 237 ff.

a subjective method, since it rests upon judgments. Each agriculturist or crop reporter who gives his opinion bases it more or less consciously on his personal recollection of the appearance of the standing crop in former years and the yield in those years. The person or board that synthesizes these opinions uses judgment, individual or collective, in giving different weights to the individual opinions of the agriculturists. Tacitly this method assumes that mistakes made by the individual observers will as often underestimate as overestimate the probable yield; that there is no bias on the part of the observers; and that, if only there be enough of them, their mistakes will cancel out, so that the final average obtained will be very close to the truth.

Yet it may be doubted that there is no unconscious bias on the part of the observers.[1] It may be questioned that the psychological factor can be ignored. One may doubt that as many farmers will be pessimists as optimists. It is not necessarily true that farmers' opinions will vary purely as a matter of chance like the flipping of a coin. The psychology of the farmer is a factor and may not obey a simple law of probability. It remains to be determined that the widespread reading of newspapers in which the weather and its supposed effects upon crops are discussed is without systematic influence upon the farmers' frame of mind. The psychological factor is very possibly different from year to year; it may conceivably vary with the farmers' economic position or with the prevailing level of crop prices or both. It may be that in a year of agricultural depression with low prices the wish is more often father of the thought than in years of agricultural prosperity. Under some circumstances it is quite possible that in some years farmers consciously or unconsciously are more prone to underestimate and in others to overestimate. That there may be bias in the reports of crop estimators is now recognized by the United States Department of Agriculture, and methods have been devised for making appropriate corrections,[2] although these methods do not seem as yet to have been published.

The inherent defects of this method of crop estimating are now so well recognized that many countries make no official forecasts of the volume of crops in advance of harvest. They limit themselves to the publication of so-called condition reports. In many countries this is done on a purely arbitrary scale of numbers, e.g., 1, 2, 3, 4, 5, one end of the scale representing a bumper crop, the other a failure. Some countries are not even as precise as this but describe the condition by such words as excellent, good, average, below average, poor, etc.[3] In the United States condition figures have for a great many years been expressed as percentages of a hypothetical normal.[4] There exists a difference of opinion whether condition figures are best expressed in percentages of such a normal or of the ten-year average. Since 1912 the United States has been issuing not merely condition figures but also forecasts of yields which are derived by calculation from the condition figures.[5]

The improvement in crop estimating by this method in recent years has taken the form of increasing the number of crop reporters, i.e., in increasing the size of the sample; in securing better crop reporters or their better distribution either geographically or in regard to the character of their farm holding or their farm operations, etc.; in the elimination of bias; and notably in devising methods of checking the reports in various ways. But in the ultimate analysis the method is based on judgments, and the very notable improvements that have been made are for the most part designed to reduce errors that are inherent in judgments. All students of the subject are agreed that another method would be extremely valuable if only as a check upon the current method; and this is recognized in the United States Department of Agri-

[1] Cf. H. Parker Willis, "The Adjustment of Crop Statistics, III," *Journal of Political Economy*, 1902–3, XI, 540–67.

[2] W. F. Callander, "Problems in Crop and Live Stock Estimating," *Journal of Farm Economics*, 1928, X, 232 ff.

[3] C. C. Clark, "International Crop Reporting Service," *Publications of the American Statistical Association*, 1910–11, XII, No. 91. For a criticism of condition figures, cf. L. March, "La statistique des états de culture," *Bulletin de l'Institut Internationale de Statistique*, 1915, XX, 649.

[4] For details see Callander, *op. cit.*

[5] *Idem.*

culture as well as elsewhere. Such a check method would be valuable in proportion to the degree to which it is objective, i.e., not based on opinion. Forecasting yields from the weather, if it is feasible, would offer such an alternative method, and research is in progress in the United States (chiefly in the Bureau of Agricultural Economics), and in some other countries, to provide a firm foundation for such procedures.

Purpose of the Present Study

In the course of the last forty years a fairly considerable literature on methods of forecasting yields from the weather has been published. Study of this literature leaves the reader baffled and confused. The one fact that stands out clearly is that the problem is far from solved. Indeed, the problem has been scarcely defined sharply. This is, of course, due primarily to the inherent difficulty and complexity of the question, for each crop and each locality presents a peculiar forecasting problem. Moreover, the solution of the problem requires the co-operation of meteorologists, agronomists, physiologists, pathologists, and entomologists. No one person is capable of mastering all the specialties involved, and co-operation between experts in these diverse sciences is difficult to secure and hard to maintain. Hitherto the bulk of the investigations has been made by statisticians or meteorologists, and in consequence comparatively little attention has been paid to the plant as a reacting organism.

The purpose of the present paper is to bring together what is known concerning the forecasting of yields of wheat from the weather and to present as simple and as lucid a picture as possible of the status of existing knowledge of this problem. This demands in the first place consideration of weather as an environmental factor, consideration of the biology of the wheat plant as the basis of its reaction to the weather, consideration of the methods used in forecasting yields from the weather, and finally a discussion of how these methods have been applied to wheat. Incidentally, reference is made to other crop plants when data on any particular point are lacking for the wheat plant. Emphasis is laid upon disentangling the numerous elements of a complex problem of fundamental importance as yet unsolved. It is hoped that interest in the possibility of forecasting yields from the weather may be stimulated and that biologists in particular may be aroused to attack some of the fundamental problems of the laws of growth of crop plants upon the solution of which in the last analysis depends the solution of the problems of forecasting crop yields by *objective* rather than *subjective* methods.

II. WEATHER FACTORS IN PLANT GROWTH

For present purposes weather may be resolved into three factors: light, heat, and moisture.

The Light Factor

Green plants cannot mature without light because it is from light—ordinarily sunlight—that they supply themselves with energy. With the assistance of sunlight they compel carbon dioxide from the air to combine with water with the ultimate result that sugar is formed.[1] This process is known as photosynthesis. The sugar (carbonaceous material) thus formed is then used as food by the tissues and organs of the plant. Plants may therefore be said to manufacture a large part of their own food. Upon the amount of carbonaceous material formed by photosynthesis depends, therefore, the rate at which the plant can grow. The formation of sugar by photosynthesis goes on predominantly in the leaves, and is, ordinarily, a function of the extent of the leaf surface that is exposed to light. Hence the extent of the leaf area is a limiting factor[2] determining how much carbo-

[1] The different steps in the process are not known with certainty, nor is the nature of the process fully understood. Cf. H. A. Spoehr, *Photosynthesis* (New York, 1926); and C. L. Alsberg, "Progress in Chemistry and the Theory of Population," *Industrial and Engineering Chemistry*, 1924, XVI, 524.

[2] There are other factors besides leaf surface, such as leaf thickness, chlorophyll content, etc.; but these need not be considered here.

naceous food shall be available to the green plant for maintenance and growth.

The amounts of carbon and energy that are assimilated depend theoretically also upon the intensity and character of the light falling upon the leaves; as a practical matter deficiency of light is rarely a limiting factor in determining growth of crops in open, unshaded fields. Brown has shown that the intensity of illumination is commonly much greater than the optimum.[1] It may be reduced to nearly one-quarter that of ordinary English sunlight before the rate of photosynthesis is changed materially. Under ordinary conditions of cultivation, therefore, sunshine is in all probability not an important factor in directly determining yields in a given locality. If, nevertheless, agricultural meteorologists and statisticians have found relationships between light intensity and yields in a given locality, this is probably due to the fact that there is a high correlation between sunshine and temperature. In other words, when it is sunny it is usually warm, and warmth, as we shall see, has important effects upon the growth rates of plants.[2] Some crops, indeed, produce best when the intensity of sunlight is below average; to some plants intense sunlight is injurious.

While in all probability the intensity of sunlight is not fundamentally important in a given locality except for its heat effects, the length of the day is most important. This changes in each latitude in a quite constant way, but it is different in different latitudes. The hours of sunlight per day of the growing season increase with the latitude. At higher latitudes the growing season is shortened, with spring coming later and autumn earlier; but the hours of sunshine are not proportionately diminished because the days are longer in summer. This is an important factor in making it possible to grow crops at high latitudes. There are of course other factors, the most important of which is perhaps that the varieties selected for cultivation at high latitudes have usually shorter growing periods than those grown nearer the equator.

The total number of hours of sunshine to which a plant is exposed during the growing season does not always determine the effect of light upon it. The ratio of length of the day to the length of the night is important—at least for certain plants—as shown by Garner and Allard.[3] Apparently in some cases plants may be brought to flower and fruit earlier or later by adjusting this ratio. Probably this phenomenon is also a factor in determining yields at different latitudes. The wheat plant, however, is not much influenced by light periodicity, for at the Food Research Institute spring wheat has been brought to maturity under continuous illumination.

The Heat Factor

A plant's temperature changes with that of its environment. Only to a limited degree can it protect itself from freezing, as by making its sap more concentrated.[4] Only by evaporating water from the surface of its leaves—a process which botanists call transpiration—can it resist heat. Transpiration is effective because as water evaporates it absorbs heat and so cools the plant. As the surface of the leaves from which evaporation takes place is comparatively great, quite large quantities of water may be evaporated by a plant and transpiration be correspondingly effective as a cooling measure.

The activity of all living substance, whether animal or plant, so far as known, is greatly influenced by temperature. Cold retards all vital processes till at given temperatures they practically cease, whereas warmth speeds them up till at certain degrees of heat life ends. The limiting temperatures, and the effects of temperature within these limits, are different for different species and varieties. So far as the effects of temperature are concerned, vital processes resemble chemical processes.

[1] H. T. Brown, "The Reception and Utilization of Energy by a Green Leaf," *Nature*, 1905, XCII, 525.

[2] Cf. also F. M. Hildebrandt, "A Physiological Study of the Climatic Conditions of Maryland, as Measured by Plant Growth," *Physiological Researches* (Johns Hopkins University), 1921, II, No. 8.

[3] W. W. Garner and H. A. Allard, "Effect of the Relative Length of Day and Night and Other Factors of the Environment on Growth and Reproduction in Plants," *Journal of Agricultural Research*, 1920, XVIII, 553 ff.

[4] R. Newton, "Colloidal Properties of Winter Wheat Plants in Relation to Frost Resistance," *Journal of Agricultural Science*, 1924, XIV, 178 ff.

Many chemical reactions approximately double their rate for each 10°C. (18°F.) rise in temperature. This is known as Van't Hoff's Law. Living things react to changes in temperature in somewhat similar proportions, and many experiments have been performed to prove that they obey Van't Hoff's Law, though without conclusive results. The point to be noted in this connection is that the activity of living things does not increase directly in proportion to rise in temperature.

Since the plant, in comparison with the animal, has no power to change its location and but limited power of control over its own temperature, the rate at which its life processes go on changes with the temperature of its environment. It must cease to grow when the temperature drops to a certain point.[1] This point varies for different kinds of plants, but for most field and garden crops it is close to 6°C. (42.8°F.).[2] On the other hand, the plant must grow more rapidly when the temperature becomes elevated up to a certain point. At temperatures much elevated above those to which it is adapted, the plant is in a state analogous to fever. Beyond a certain point excessive heat means death. A crop growing in the open fields subject to all the vicissitudes of the elements grows very irregularly—faster on warm days, more slowly or not at all on cold ones.

One must distinguish the manner in which light is useful to plants from the manner in which heat is useful. Light serves as a direct source of energy, without which the green plant can neither live for long nor grow. Heat is not a form of energy that plants can use directly. It is necessary to plants not for itself but because it creates conditions that make chemically possible the various life processes. It is not changed by the plant into some other form of energy as is light in photosynthesis. In fact, heat is formed by plants when they transform food materials in their life processes. Warmth is to be regarded then as a condition for growth, not as taking part in the growth processes like light and plant foods. Indirectly, of course, heat shares in the vital processes, as when it is absorbed in the evaporation of water in transpiration and so serves to cool the plant. When agricultural meteorologists write, as they often do, of the total degrees of temperature a plant requires to reach maturity, they do not mean what plant physiologists mean when they speak of the amount of potash or nitrogen required by a plant. These are actually used by the plant; indeed, they are incorporated in it. What the agricultural meteorologist means is that the temperature must reach a certain level for a certain length of time for the maintenance of the chemical processes necessary to enable the plant to mature.

These temperatures vary for different species of plants and even for different varieties of the same species. For most plants there is a considerable range of temperature over which they will grow and mature, but since the life processes go on at different rates at different temperatures the lengths of the different growing periods are modified by the prevailing temperatures. They may be shortened or lengthened. The plant may bloom earlier or later.[3] The phenomenon is complex. There are other factors besides temperature, but this is not the place for a full discussion of the subject.

Hence most plants grow only when the temperature remains within certain limits. When it rises too high or falls too low they may become dormant or die. Low temperatures may hinder germination, stop or retard growth, or actually injure and kill. High temperatures, among other effects, tend to produce dessication, as we shall see. Most crops of temperate regions grow when the mean daily temperature ranges from 9.4° to 22.2°C. (49° to 72°F.).

Warmth acts not merely upon that part of the plant that is above ground but also upon the subterranean parts. Soil temperature is a most important factor in the plant's environment. The heat of the soil is derived from the sun, but a trifling

[1] The application of this idea to growth is apparently due to De Candolle. Cf. E. J. Salisbury, "Phenology and Habitat with Special Reference to the Phenology of Woodlands," *Quarterly Journal of the Royal Meteorological Society,* 1921, XLVII, 231.

[2] The British Meteorological Office adopted 42°F. as the critical point. Cf. E. Mawley, "Weather Influences on Farm and Garden Crops," *Quarterly Journal of the Royal Meteorological Society,* 1898, XXIV, 63.

[3] Cf. A. J. Connor, "Relation of the Weather to the Yield of Wheat in Manitoba," *Monthly Bulletin of Agricultural Statistics* (Canada), April 1918, 115 ff.

amount also comes from the interior of the earth. In summer, heat is lost in the strata below the surface. The temperature of the surface soil is influenced by many factors such as physical state, water content, covering with vegetation or snow, and the like. Soil temperature affects both the germination of seeds and the growth of plants.

The Moisture Factor

As plants require a certain amount of light and heat to live and grow, so they require a certain amount of moisture. This they derive by absorption from the soil through the roots. At the same time that plants are absorbing moisture from the soil they are losing moisture by evaporation (transpiration), principally from the surface of the leaves. In order that the plant may always have in its body enough water to carry on its life processes it must, obviously, absorb as much through its roots as it loses through its leaves. The two must approximately balance. Disturbance of this balance may be brought about by either of two sets of conditions or by both combined. First, there may be so little moisture in the soil that the roots are powerless to furnish it to the plant as rapidly as moisture is lost by evaporation from the leaves. Secondly, the plant may evaporate moisture at so rapid a rate that the roots cannot keep up the supply even though there be enough available moisture present for them to meet the demands of a less rapid transpiration. Not at all infrequently too scanty soil moisture and very rapid transpiration occur at the same time.

The quantity of moisture entering unirrigated soil depends primarily upon the amount of precipitation, principally rain and snow; the actual precipitation, however, is less important for the plant than the amount that remains in the soil for the plant to use. This depends upon many other factors, the most important of which are the run-off and the time when the precipitation occurs.

The run-off is the amount of water that runs off into brooks and streams without sinking into the soil. It depends upon many conditions. More moisture will run off a hillside than off a plain. Obviously, if a given amount of rain falls in a short time, more will run off than if the same amount is spread over a longer time. Obviously, too, rain will sink more quickly into sand than into clay. On the other hand, more water will be held by clay than by sand because less will be lost by subsoil drainage. In any given locality underground drainage conditions will be important in determining how much of the precipitation will remain as soil moisture.

If the soil is bare of vegetation and hard baked, more will run off than if the soil is covered with grass, shrubbery, or forest. On the other hand, vegetation growing upon the soil tends to reduce soil moisture because the growing plants use it up. The cultivation of fields lying fallow has for one of its purposes the destruction of weeds in order to prevent their exhausting soil moisture. Another purpose is to break up the hard surface layer so that rain may sink into the soil more readily and not run off. This cultivation has another effect: moisture evaporates from the surface of the soil; as the surface dries out, fresh moisture is drawn up to it by capillary action through the pores of the soil. Cultivation breaks the continuity of the capillary pore spaces and so lessens the rate at which water reaches the surface and is evaporated.

If moisture falls in the form of snow, anything that causes the snow to melt slowly must reduce the run-off and give time for more of the snow water to seep into the ground. This will be favored if the spring is late or if the land is covered with forest trees that intercept the sun's rays.

The amount of soil moisture available to the plant is not, however, indicated by the percentage of moisture in the soil. The availability depends in large measure upon the character of the soil. Not all the moisture of the soil is free; some of it is so tightly held by the constituents of the soil that it is not available to the plant. The degree to which this occurs varies in different soils; it is least in sand which holds but little of the water firmly; it is greatest in certain types of heavy clays which hold considerable water so tightly that plants cannot absorb it.

The time when precipitation occurs is also of great importance to the plant. Some

of the soil moisture used by crop plants, especially in semi-arid regions, may have entered the soil and been stored there before the crop was planted. In analyzing the effects of precipitation upon crop yields, it is, therefore, necessary sometimes to go back to a consideration of the weather before the crop is even planted. Plants require different amounts of moisture at different periods of their growth. Rain that falls at a time when the plant requires little of it may be of no use to the plant, because by the time it is needed it may have largely disappeared from the soil. In considering the suitability of any climate for a given crop it is necessary to know not merely the annual rainfall of the region but also how it is distributed week by week through the year. In the life of each plant, some days are crucial. Similarly in attempting to estimate the effect of rainfall upon the probable yield, it is necessary to know at what stage of the plant's growth it fell and what the plant's requirements are at that time. The first is easily obtained from meteorological data. Concerning the second we are as yet largely ignorant because so little is known concerning growth rates of crop plants and concerning their requirements at different growth stages. So far as anything is known about these requirements it has been inferred from the results of statistical studies of correlations between rainfall data and crop yields in previous years. From such correlations, indeed, in the absence of exact physiological experiments, attempts have been made to reason concerning the requirements of plants at different stages.

Humidity and temperature are also important factors in determining soil moisture. When the air is very humid, evaporation from the soil's surface is less, other things being equal, than when the air is dry. High temperatures, as every one knows, increase evaporation. As important as humidity and temperature are air currents, and especially high winds. Wind is of importance in all countries, but in some regions it is of outstanding significance. The winds from one direction may be warm or cold, moist or dry, gentle or strong. Thus the monsoon of India and the Chinook of western Canada exercise a determinative influence on the crops of a particular year. Many regions have definite prevailing winds, persistence in or variation from which greatly modifies the other climatic relations. Winds may do damage not merely by beating down the crop or by causing grain to shatter, but also by greatly increasing evaporation. Hot dry winds are especially injurious not merely by depleting the store of water in the soil, but also by increasing greatly the plant's transpiration and making the maintenance of the plant's water balance difficult. As we shall see, when hot, dry winds come at the time of flowering of the wheat plant, they are especially injurious and favor the formation of sterile heads. Hence, when there is a combination of low humidity, high temperature, and strong wind, the soil loses much water by evaporation. Unfortunately, but little attention has been paid to evaporation. Chilcott seems to be the only man who investigated the question adequately.[1] He reached the conclusion that in the Great Plains area of the United States, a semi-arid region, evaporation is at least as important as precipitation.

It is clear then that while precipitation determines by and large the amount of available soil moisture, a given amount of rain or snow does not everywhere and at all times raise the total soil moisture to the same degree. Still less does it necessarily increase the moisture available to the plant to the same degree, for the fraction that is available depends in larger measure upon the amount of moisture left in the soil at the time the plant needs it than upon the amount of precipitation.[2] The actual moisture available in the soil is by far the more significant fact. Yet most investigators, as we shall see, have dealt with the total precipitation rather than available soil mois-

[1] E. C. Chilcott, *The Relations between Crop Yields and Precipitation in the Great Plains Area* (U.S. Department of Agriculture Miscellaneous Circular No. 81), 1927.

[2] "Because of differences in time and manner of distribution, amount of run-off, which in turn is influenced by soil structure, rapidity of evaporation, etc., rainfall alone, indeed, yields data of little value in a study of the water relations of crop production." —J. E. Weaver, F. C. Jean, and J. W. Crist, *Development and Activities of Roots of Crop Plants; A Study in Crop Ecology* (Carnegie Institution of Washington, Publication 316), May 1922, p. 33.

ture.[1] The reason is not that they have been unaware of the greater significance of available soil moisture, but rather that rain- and snowfall data are easily obtainable whereas soil moisture data are not generally available. These can be obtained exactly only by appropriate analysis. If moisture determinations were substituted for precipitation data in making forecasts, it is extremely probable that these would gain materially in accuracy; indeed, this procedure has actually been practiced by Broonoff.[2]

Some of the very factors that reduce soil moisture, notably low humidity, high temperature, and wind, greatly raise the moisture requirements of plants. They increase evaporation from the leaves and therefore increase transpiration. So it comes that a luxuriant vegetation is possible as one approaches the poles of the earth with a rainfall that in warmer regions is quite incapable of supporting any vegetation at all. In high latitudes, 250 millimeters (9.8 inches) of precipitation per annum are ample to grow a crop of grain. In the Sahara there are considerable areas with 800 to 900 millimeters (31.5 to 35.4 inches) of rain yet quite incapable of supporting agriculture.[3]

If soil moisture conditions, temperature, humidity, and air currents are such that the balance between moisture loss by transpiration and moisture absorption through the roots is disturbed, the plant dries out, dessicates, and must ultimately die if the disturbance of balance continues. Certain plants, including some of the sorghums and millets, have various means of protecting themselves more or less perfectly against dessication so that they seem to stop growing for a time till rain comes. Some, like the sugar beet and alfalfa, protect themselves to some extent by developing a tap root system that follows the ground water to considerable depths as the water table sinks. Other plants with but a shallow root system depend principally upon water near the surface and are soon damaged by continued lack of rain. Hence the effect of a small amount of precipitation may be very different on different plants. It is believed that small rainfalls during a drought may actually do more harm than good, because by merely wetting the surface of the ground an effective dust mulch may be destroyed and thus more water lost to the crop by evaporation than has been gained by the shower. Or numerous light showers during early growth, by merely wetting the surface, may cause certain crop plants to root near the surface where the soil will quickly dry out in later dry spells.[4] In any event, if the water balance is seriously disturbed the plant is injured, if it is not killed, and this injury tends to reduce yields. Hence the conditions disturbing the water balance of plants are fundamental in forecasting yields and for this reason they have been considered in some detail in this section.

Excessive rainfall as well as deficient rainfall may hurt crops. Opinions differ in regard to how excessive rain does injury. Lawes and Gilbert suggested that too much rain hampered root development and washed out nitrates from the soil.[5] Fisher, from a study of the effect of rain on different wheat plots more or less heavily fertilized, has brought forward strong evidence in support of the suggestion that a large part of the ill effects of too much rain is due to the leaching out of nitrates. He also pointed out that, since much rainy weather at the time of fall plowing and sowing of winter wheat tends to reduce acreage because the soil is not in condition to be worked, there is likely to be a selective restriction of acreage. Some kinds of land are more easily made unworkable by rain than others, and, therefore, conceivably, heavy autumn rains may change the average character of the land that is actually sown to wheat and thus indirectly affect

[1] Cf. J. B. Kincer, "Forecasting Crops from Weather Conditions," in *The Problems of Business Forecasting; Papers Presented at the Eighty-fifth Annual Meeting of the American Statistical Association, Washington, D.C., December 27–29, 1923,* edited by W. M. Persons, W. T. Foster, and A. J. Hettinger, Jr. (New York, 1924), p. 265.

[2] P. Broounoff, "Crops and the Weather. Monograph on the Adaptation of Farmers to Climatic Conditions," *Bulletin of Foreign Agricultural Intelligence* (Canada), 1916, VI, 372.

[3] F. Aeroboe, *Allgemeine Landwirthschaftliche Betriebslehre* (Berlin, 1923), p. 450.

[4] J. Warren Smith, *Agricultural Meteorology, The Effect of Weather on Crops* (New York, 1920), p. 166.

[5] J. B. Lawes and J. H. Gilbert, "Our Climate and Our Wheat Crops," *Journal of the Royal Agricultural Society,* Second Series, 1880, XVI, 173 ff.

the average yield of the region.[1] In this connection, it is significant to note that Gericke found that the quantity of nitrogen available to the plant greatly influences the lengths of the different growth periods and that the application of nitrogenous fertilizers has very different effects at different stages.[2] Moreover, Gericke has also shown that the amount of nitrogen available has very great influence on root development.[3] No doubt these factors contribute to the varying effects of rainfall. Finally, rainfall has three other effects of possible significance in the present connection: one is that rain carries air into the soil; another is that rain greatly influences the temperature of the soil; the third is that heavy rains may favor the growth of weeds. Fisher has brought forward evidence to indicate that the evil effects of a succession of wet years may be due in part to excessive growth of weeds.[4]

III. PLANT REACTIONS TO WEATHER FACTORS

How plants react to their environment has been studied by direct observation of crops growing in the field, by observation of plants growing under carefully controlled experimental conditions, and by the statistical analysis of past crops and past weather records. We shall have more to say about these methods of study later. For the moment it is sufficient to note some of the more important known reactions without troubling to ascertain how they were discovered.

Some Pertinent Distinctions

The reaction of plants to their environment has been treated to some extent in the preceding section. It is different at different stages of their development. It is different for different species. One must distinguish especially between annuals, biennials, and perennials. It is obvious that injury done to an annual plant has, ordinarily, more profound effects upon its subsequent life than a similar injury to a perennial, for the annual has but the remainder of the growing season to recover, whereas a perennial, if it survives the injury, may ultimately repair itself in subsequent years. In this study we are concerned solely with annuals.

Furthermore, we must distinguish between vegetative and reproductive growth. Reproductive growth is the production of flowers, fruit, and seed; vegetative growth, the production of all other organs. The laws that govern the two, so far as they are known, are in certain respects quite different. The external conditions that favor vegetative growth do not necessarily favor reproductive growth, and vice versa. It is well known that the rankest-growing wheat field does not necessarily yield the most seed, though it does furnish the most straw. Indeed, for certain plants there is good evidence of the existence of a sort of antagonism between vegetative and reproductive growth.[5] Alfalfa presents a good example. When there is plenty of moisture, a rank vegetative growth is produced; the crop goes for hay. When droughty conditions threaten the life of the plant there is a prolific production of seed.[6] Therefore, in assessing the influence of weather upon crop plants, one must distinguish between those which are cultivated chiefly for their vegetative parts and those which are grown

[1] R. A. Fisher, "The Influence of Rainfall on the Yield of Wheat at Rothamsted," *Philosophical Transactions of the Royal Society of London*, Series B., 1925, CCXIII, 89 ff.

[2] W. F. Gericke, "Certain Relations between the Protein Content of Wheat and the Length of the Growing Period of the Head-bearing Stalks," *Soil Science*, 1922, XIII, 135 ff.; "Differences Effected in the Protein Content of Grain by Applications of Nitrogen Made at Different Growing Periods of the Plants," *ibid.*, 1922, XIV, 103 ff.

[3] W. F. Gericke, "Certain Relations between Root Development and Tillering in Wheat: Significance in the Production of High-Protein Wheat," *American Journal of Botany*, 1922, IX, 366 ff.

[4] R. A. Fisher, "Studies in Crop Variation. I. An Examination of the Yield of Dressed Grain from Broadbalk," *Journal of Agricultural Science*, 1921, XI, 107 ff.

[5] Cf. also discussion on R. H. Hooker's paper ("Forecasting the Crops from the Weather") in *Quarterly Journal of the Royal Meteorological Society*, 1921, XLVII, 249.

[6] J. C. Alter, *Alfalfa Seed Growing and the Weather with Particular Reference to Conditions in Utah* (Utah Agricultural College Experiment Station Bulletin No. 171), 1920, p. 8.

mainly for their seed. The weather that favors one not infrequently is disadvantageous to the other. Crops in the first class are the various sorts of hay, root crops, sugar cane, and tobacco. Crops in the second class include all the grains, flax when grown for seed and not for fiber, the pulses, cotton, nuts, and fruits.

The phenomenon just described is perhaps nothing but a special case of Darwin's law that fecundity is related to the chances of survival; or, in the language of the psychiatrist, the stimulation of reproductive growth by unfavorable conditions may be looked upon as a sort of defense reaction. So long as the parent plant finds living conditions easy, it is under no special urge to reproduce abundantly; the production of small numbers of offspring suffices to insure survival of the species. When, however, living conditions are hard, the chance of survival of offspring is small, and the plant reacts by producing a large number of offspring. On the other hand, all seed crops are very sensitive to injury during the short period of flowering and seed formation, for injury at this period leads to more or less complete loss of the whole crop. Vegetative crops, especially root crops, on the contrary may during drought become more or less dormant; so long as they are not killed, subsequent precipitation can start them growing again so that they yield something and not infrequently considerable quantities if the subsequent weather is very favorable. Hence a seed crop as a rule is more exacting in its meteorological requirements than a vegetative crop.

Stages of Plant Growth

It would take us too far afield to consider in detail the general subject of the physiology of plant growth. So far as that is necessary for present purposes we need consider only certain aspects of some of the stages of growth of the wheat plant. The growth cycle of wheat has been divided into different stages by different investigators. J. Warren Smith recognizes the following "important periods of growth" of wheat:[1] germination, tillering, jointing, heading, blossoming, and ripening. Broonoff gives the following phases for winter cereals:[2] (1) from seeding to appearance above ground; (2) from appearance above ground to the day when the layer of snow becomes firmly established; (3) from the day when the layer of snow becomes firmly established to the period of the thawing of the snow; (4) from the period of the thawing of the snow to heading; (5) from heading to "waxy" maturity (apparently the dough stage of the seed). Azzi, since he made his studies at Bologna, Italy, where snow plays no rôle, reduced Broonoff's phases for spring cereals to three:[3] (1) from seeding time to appearance above ground; (2) from appearance above ground to heading; (3) from heading to maturity.

In the present paper we shall consider five periods, one of which precedes the time of sowing. These divisions are: (1) the formation of the seed to be sown; (2) germination and the formation of the first leaf; (3) growth after the formation of the first leaf to heading; (4) heading and flowering; (5) formation and maturing of the grain.

1. *Formation of the Seed*

It has long been known that the character of the seed has a considerable effect upon the character of the yield. "Spring-wheat seed obtained from farther north will ripen earlier and give a better yield and quality than seed from the same strain ripened farther south. Winter-wheat seed, on the other hand, from points farther south will give better yields than northern grown seed of the same variety."[4] This is true of a number of other crops. Hooker has shown that in England the weather during the maturing of peas and beans has a very great effect on the yield of the crop from this seed.[5] He has also shown that

[1] Smith, *op. cit.*, 1920, p. 186.

[2] P. I. Broonoff, "The Meteorological Bureau and Agricultural Meteorological Stations Directed by the Bureau in 1901," *Memoirs of Agricultural Meteorology* (Petrograd), 1901, No. 1.

[3] G. Azzi, "The Importance of Agricultural Meteorology from the International Point of View," *Bulletin of Foreign Agricultural Intelligence* (Canada), February 1916, VI, 138.

[4] Smith, *op. cit.*, 1920, p. 252.

[5] R. H. Hooker, *op. cit.*, 1921, and "The Weather and the Crops in Eastern England, 1885–1921," *Quarterly Journal of the Royal Meteorological Society*, 1922, XLVIII, 115 ff.

there is a distinct tendency, at least in England, for an above-average crop of winter wheat to be succeeded by one below average, a relation for which he can find no explanation other than some character inherent in the seed.[1]

It follows, then, that study of the reaction of the crop to weather must be extended back into the period of the preceding crop year when the seed was formed. This may be necessary also because, as pointed out above, conditions obtaining for some time before sowing may influence materially the soil moisture available. In England, however, where the rainfall is above the optimum for wheat, Fisher found no correlation between the weather in the months preceding sowing and wheat yields.[2] The study of perennial crops may sometimes have to be extended back even into the preceding year. Thus "a dry and warm June usually precedes a good apple crop the following year. As the fruit buds develop in the preceding year and as wet weather favors active extension growth which is produced at the expense of fruit-bud formation, it follows that a dry and warm June should be favorable for the formation of a good number of fruit buds for the next year's crop. A good rainfall in June produces a large amount of soil moisture when the buds are developing, thus making a preponderance of extension growth and thus a larger percentage of branch and leaf buds and a smaller percentage of fruit buds."[3] In other words, here, too, is an example of the antagonism between vegetative and reproductive growth discussed above.

It is not so easy to explain why the conditions under which the seed of an annual has been formed should influence the yield. Sometimes it is undoubtedly less an effect of weather conditions on the development of the seed than direct injury to the mature or maturing seed, as when there is wet weather after wheat is in the shock causing it to sprout or mold. Wet weather near harvest apparently acts unfavorably in this manner upon peas and beans in England.[4]

In other instances the explanation is unquestionably more subtle. Possibly in these we have to deal with another aspect of Darwin's law that fecundity is related to the chances of survival. Perhaps this aspect of Darwin's law might be formulated thus: When the chances of survival of a species are suddenly reduced, the generation first subject to the adverse conditions responds with the production of offspring with greater vigor or fecundity than their parents, or both. Hooker found for wheat[5] that in England a warm June and July result in the production of good quality of seed but not a great yield.[6] But this law is merely a general statement of observed facts; it is not an explanation.

When we seek for the mechanism involved, it is hard to discover. A number of possibilities suggest themselves. A poor wheat crop is apt to be one in which the individual kernels are light; those of a good crop heavy. If a farmer always plants the same volume or weight of seed to the acre, he will be apt therefore to sow more seeds to the acre when the seed is from a poor crop than when it is from a good one. The result may be that he has a denser stand of plants from the poor crop seed than from the good. This may possibly account for the difference in yield,[7] though it

[1] Hooker, *op. cit.*, 1922. [2] Fisher, *op. cit.*, 1925.

[3] Smith, *op. cit.*, 1920, p. 127.

[4] Hooker, *op. cit.*, 1922. [5] *Ibid.*

[6] Perhaps the quality of crops raised in different regions is an expression of the same phenomenon. The highest qualities of many crops are produced only where conditions are far from optimal (cf. Hooker, *op. cit.*, 1922). The best oranges are grown at the very limits of orange culture (cf. W. G. Reed, "Frost in the United States," *Proceedings of the Second Pan American Scientific Congress.* Section II, Astronomy, Meteorology, and Seismology, 1917, II, 593; also J. E. Corts, *Citrus Fruits* [New York, 1915], p. 25). The better classes of wheat are grown either so far north or at so high altitudes that there is grave danger of frosting, or in regions so arid that there is danger of crop failure. Of course, quality is a man-made concept. It may have nothing whatever to do with any defense reaction of the plant. However, the fact that high-quality agricultural products are produced so frequently only near the limits of possible cultivation is at least significant. It has certain important economic results. The product of high quality is greatly prized; in consequence it brings a relatively high price. The high price of the quality product tends to increase the acreage at or near the possible limits of cultivation. Production in such localities is more hazardous and the hazards color the whole picture of marginal production. These considerations affect also, as we shall see, the problem of forecasting, for where marginal conditions prevail the forecasting problem is not the same as in regions where conditions are at or near the optimum for the crop plant.

[7] *Hearings on H.R. 7401 before the House Committee on Agriculture,* June–July 1921 (preliminary print), p. 109.

is but fair to say that, while agricultural scientists have performed many experiments to determine whether dense or thin sowings and whether light or heavy seed give the best yields, agreement on these points has not yet been reached. Probably there is no one answer, and different results are obtained with different wheat varieties, different soils, and different climates.

Perhaps the explanation is to be sought rather in the fact that most crops are not composed of pure lines, and are therefore aggregations of individuals of varying character. The different individuals even of a pure line show not a little variability. One of the variable characters is undoubtedly ability to resist adverse conditions. Greater resisting powers are no doubt sometimes associated with greater ability to produce seed under adverse circumstances. Consequently, the offspring of the more resistant individuals will be represented in greater numbers in the harvest when conditions are adverse then when they are favorable; and this may have its effects upon the following crop.

Another possibility is suggested by an observation, as yet not published in detail, of H. L. van de Sande-Bakhuyzen in his study of the growth of the spring-habit wheat, Hard Federation, under constant illumination, humidity, and temperature, made at the Food Research Institute.[1] The observations seem to indicate that the extent to which a seedling exhausts the endosperm determines the size of the first leaf. The endosperm, it will be recalled, is the flour-containing part of the seed and constitutes its major portion. In germination the embryo or germ as it develops into the seedling feeds upon the endosperm until the seedling has acquired a root system capable of drawing its material sustenance from the soil. Until the roots begin to function the first leaf is formed at the expense of the reserve food material in the endosperm. It is obvious, then, why there should be a correlation between the degree to which the seedling exhausts the endosperm and the size of the first leaf. But the size of the first leaf profoundly affects the future growth rate of the plant, for reasons which will be made clear below.

We do not yet know what determines whether a given seedling consumes its endosperm more or less completely. It may be that it depends upon purely fortuitous circumstances, such as slight variations in the depth of the seed beneath the soil surface and the like. But it may well be that the power to exhaust the food supply of the endosperm is really inherently different in different individual seeds. It is probably not very closely correlated with size of the seed, for in his experiments van de Sande-Bakhuyzen used seeds of very nearly the same weight. But the ratio of endosperm to total weight may not have been constant. Perhaps it is correlated with the weather conditions prevailing while the seed was formed; but this is merely a speculation to be tested by future research.

2. *Germination and Formation of the First Leaf*

The conditions for germination are a sufficiently high soil temperature and adequate moisture. According to Sachs wheat can germinate at +5°C. (41.0°F.).[2] The maximum is 36° to 38°C. (96.8° to 100.4°F.) and the optimum 20° to 25°C. (68° to 77°F.). If wheat is sown too early in the fall, while the ground is warm, plants may start well but will soon decay. In India it is considered safe to seed when the temperature of the soil has fallen to about 25°C. (77°F.) but not when it is as high as about 30°C. (86°F.).[3] On the other hand, if the seeding is done so late that the soil temperature is so low that germination is slow or does not take place at all, the plant cannot get a proper start before winter sets in. And so a very late summer in the warmer regions of wheat culture or a very early winter in the cooler regions of wheat growing may greatly diminish the yield of winter wheat. A very late spring may delay seeding of spring wheat and so injuriously shorten the

[1] H. L. van de Sande-Bakhuyzen, "Studies upon Wheat Grown under Constant Conditions, I," *Plant Physiology*, 1928, III, 1 ff. Cf. also C. L. Alsberg and E. P. Griffing, "The Objectives of Wheat Breeding," Wheat Studies, 1928, IV, 280.

[2] J. Sachs, "Zur Keimungsgeschichte der Gräse," *Botanische Zeitung*, 1862.

[3] Smith, *op. cit.*, 1920, p. 183.

growing period that the plants become frosted in the fall before the seed is mature. Or, if after seeding the weather turns cold for any extended period, the evil results may be the same.

It seems fairly certain that wheat needs only sufficient moisture during the first six weeks of its life to keep it growing vigorously.[1] Too much moisture may under some circumstances be unfavorable.[2] On the other hand, so is too little. If the fall is very dry, the wheat may be so delayed in germinating that cold weather overtakes it before the plants have established themselves.

The time that elapses between seeding and the emergence of the plant varies with the variety and with the environmental conditions of which soil temperature and moisture seem to be the most important. In northwestern Ohio it averages nine days.[3]

Furthermore, as indicated in the preceding section, the manner of germination of spring wheat is very important, since it determines the size of the first leaf. But the size of the first leaf determines the size of the second leaf, and the first and second leaves together determine the size of the third, and so on, till in the end the size of the first leaf determines the size of the plant itself. These close interrelations are the consequence of the manner in which green plants supply themselves with energy by photosynthesis. As has already been pointed out, the extent of the leaf area is the principal factor determining how much carbonaceous food is available to the plant for synthesis and growth. Now we see why the size of the first leaf of spring wheat, which has a short growing period and produces only a small number of leaves, determines the rate of subsequent growth. If the first leaf is small, it can make only a small amount of sugar and furnish, therefore, only a small amount of food for the growth of the second leaf; the second leaf will also be small. If on the contrary, the first leaf is large, it will make much food available for the formation of the second leaf and this also will be large. As the second leaf begins to function, it too synthesizes sugar and contributes to the supply of food available for the formation of the third leaf. If both the first and second leaves are large, the third leaf will, therefore, be large, and this cumulative process will go on with the formation of each new leaf affecting in the end the size and vigor of the fully grown plant.

Whether the same phenomena occur in winter wheat has not yet been investigated. It is to be anticipated, however, that, in all probability, if the same relations between exhaustion of the endosperm and size of the first leaf hold also for winter wheat, the final effect upon the plant as a whole is likely to be much less than is apparently true for the spring-habit wheat, Hard Federation. Winter wheat has a much longer growing period. Differences in assimilation rates, i.e., in photosynthesis, should produce less pronounced effects. Moreover, it tillers[4] much more vigorously than spring wheat, so that finally a single seed forms a clump. Whether such a clump is an individual or a colony, is by no means certain.[5] In either case, the clump is almost sure to reflect the condition of the seedling six or eight months previous much less than does the spring-wheat plant with only a few tillers and a very much shorter growing period. The fact that winter wheat may sometimes be pastured during the winter without ruining the crop is evidence in support of this view.

3. *From the Formation of the First Leaf until Heading*

During this period, the longest in its life, the wheat plant (spring or winter) is apparently far less sensitive to weather conditions than during the period of germination. In the earlier stages of the period immediately following germination and emergence of the plant it seems more susceptible to adverse influences generally

[1] Smith, *op. cit.*, 1920.

[2] R. H. Hooker, "Correlation of the Weather and Crops," *Journal of the Royal Statistical Society*, 1907, LXX, 1 ff; Fisher, *op. cit.*, 1921.

[3] Smith, *op. cit.*, 1920.

[4] By tillering is meant the habit that wheat shares with many other grasses of dropping some of its branches to the ground and so growing roots at the nodes or joints of the branches.

[5] F. L. Engledow and S. M. Wadham, "Investigations on Yield in the Cereals," *Journal of Agricultural Science*, 1924, XIV, 71 ff.

than in the later ones. It is especially important that a good root system be developed early and that tillering be good—especially with winter wheat. Too little moisture and too low soil temperatures are unfavorable, although, as we shall see, moisture requirements vary. In some regions there is rarely too little, and often too much; in others there is rarely too much, but often too little. A strong root system is obtained with only a moderate amount of moisture, but strong tillering seems to require somewhat more. Early tillering is important so that the plant may soon cover the ground and thus fight weeds more successfully. Too early sowing, however, if October is warm, increases the danger from the Hessian fly in many sections of the United States.

Growth of winter wheat through the winter is subject to certain unfavorable environmental conditions. In very humid climates too much moisture is unfavorable.[1] In other dryer climates there is danger of winterkilling, which will be discussed at greater length later. A dry April seems to be unfavorable to Hessian fly damage.[2] In regions with mild winters, warm weather seems favorable,[3] for in such climates considerable growth may be made, when warm days occur. Haberlandt gives 4.5° C. (40°F.) as the minimum temperature for the growth of wheat, and Azzi in studying the effect of winter weather upon wheat assumed that there is suspension of growth when the average temperature in the daytime is less than 4° C. (39.2° F.).[4]

For spring wheat the principal things to note are that moisture and temperature conditions apparently, so far as they exert an influence, act by lengthening or shortening the period under discussion. Connor believes the longer the interval between emergence and heading,[5] the greater the yield, and finds a positive correlation between the yield of straw and the length of the period from appearance to heading. There should, therefore, be a positive correlation between the yield of straw and the yield of grain, yet this seems to be true only for small and large yields of grain, intermediate yields of grain varying independently of the yield of straw.

On the whole, however, most investigators have found that the wheat plant shows relatively little response to variations in weather conditions in the period under discussion provided these variations are not extreme. It should be noted, however, that some have regarded the period immediately before heading, as we shall see, as one in which the wheat plant is quite susceptible to the weather.

4. *Heading and Flowering*

It is now very generally agreed that cool weather and plenty of moisture at the time of heading or flowering are favorable to good crop yields, at least in climates that are not too humid. Opinions differ in regard to the exact stage at which these conditions should prevail. Some think they should prevail just as the plants are beginning to head, others between the boot and bloom periods, and still others between the bloom and milk stages.[6] It seems quite well established that high temperature and lack of moisture at the time of blooming tend to produce sterile heads. This tendency is aggravated if at the same time there are high winds which increase the already high transpiration.

Broonoff found the ten days before heading most important, rain being needed at that time.[7] He studied wheat by five-day periods which he called "pentads." Azzi also examined short periods[8] and reached the same conclusion for Italy that Broonoff did for Russia. Azzi found that rain within ten days before and during heading and flowering is very favorable. Unfortunately, his series of observations covered a very short period—only five years. He found further that lack of rain during the above period may be compensated for, if

[1] Hooker, *op. cit.*, 1907.

[2] W. R. Walton, *The Hessian Fly and How to Prevent Losses from It* (U.S. Department of Agriculture Farmers' Bulletin 1083), March 1920.

[3] Hooker, *op. cit.*, 1907.

[4] G. Azzi, "The Influence of Meteorological Factors on the Yield of Wheat in the Province of Bologna, Italy," *Bulletin of Foreign Agricultural Intelligence* (Canada), March 1916, VI, 227.

[5] Connor, *op. cit.*

[6] Cf. Smith, *op. cit.*, 1920, p. 191.

[7] P. I. Broounoff, *Les Cultures Agricoles et le Temps* (Petrograd, 1912).

[8] Azzi, *op. cit.*, February 1916, p. 141.

there is enough rain in the preceding ten days to carry over.[1] Most other investigators have studied the effect of weather during intervals longer than five or ten days. Since the flowering period is brief these investigations have not been able to settle the question whether the critical time is before, during, or after flowering. They have merely determined the general time when plenty of moisture and cool weather are important. Broonoff is quite right in believing that most can be learned by studying successive five- or at most ten-day periods of growth.

The situation is further complicated by the fact that wheat does not each year head and flower at the same calendar date. Connor, writing of Canadian conditions, puts it thus: "Now the time of heading of wheat is a moving point, the motion inverse to the minimum temperature, and therefore any selected periods in days before heading, if expressed in terms of age of plant, is itself a variable depending on the weather since appearance."[2] Most investigators have lacked data on the exact time of heading and flowering; they have usually had data merely on the temperature day by day, the rainfall day by day, and the yields. They have rarely had data on the exact time of heading and flowering. Therefore, their conclusions have had to deal with the general rather than with the precise stage of growth of the plant.

A further consequence of the fact that so long a period is commonly studied is that no satisfactory answer has been given to the question why the heading and flowering period demands cool temperatures and moisture. Of course, it is assumed that in general there is some relation with increased transpiration but most investigators make no attempt at an explanation. Connor, however, offers one.[3] He is of the opinion that if in the earlier stages of the wheat's growth there be cool and rainy weather, the heading will be delayed and the subsequent yield will be heavy, but if the weather be warm and dry, heading will be hastened and the subsequent yield light. This he explains by the assumption that at any instant the height of the straw is a measure of the total nutriment received. But since a portion of this nutriment is expended in producing the straw, and a part expended in the energy of the life processes, the total will not be directly proportional to the yield in grain. Connor suggests tentatively that the amount of starch stored varies with the water transpired, a hypothesis that would explain the findings of Thatcher[4] that less starch is formed in shade-grown plants. Furthermore, Connor, perhaps, gave more importance to growth conditions in the earlier stages than do most other investigators because he studied growth by thirty-day periods, which are much too long to make possible the recognition of special conditions at the time of heading and flowering.

Connor is right, however, in his endeavor to put the phenomena upon an underlying physiological basis, as has been shown recently at the Food Research Institute by van de Sande-Bakhuyzen,[5] who was able to show that at the time of flowering there is a great increase in transpiration without any change in the environment whatever. This definitely fixes flowering as the most exacting period of those now under consideration—at least for the wheat van de Sande-Bakhuyzen studied, Hard Federation. These experiments explain why this period is so critical. If transpiration increases greatly there is a tendency to disturb the water balance of the plant. The demand upon the roots for moisture is increased. The roots have difficulty in meeting it. Anything that diminishes transpiration, such as cool, overcast, humid weather, diminishes the demand upon the roots; and, conversely anything that increases transpiration, such as hot, dry, windy weather, increases the demand upon the roots. If transpiration becomes too great, the roots are overtaxed; they supply the plant with less water than it loses by transpiration; the plant dries out, and is injured. Van de Sande-Bakhuyzen was

[1] Azzi, *op. cit.*, March 1916, p. 227.

[2] Connor, *op. cit.*

[3] *Idem.*

[4] R. W. Thatcher, *A Report of the Investigations Concerning the Chemical Composition of Wheat, 1906 to 1912 Inclusive* (State College of Washington Agricultural Experiment Station Bulletin No. 111), 1913.

[5] H. L. van de Sande-Bakhuyzen, "Studies upon Wheat Grown under Constant Conditions, II," *Plant Physiology*, 1928, III, 7 ff.

able to show that under environmental conditions that may be considered normal and under which the roots are quite up to the task of supplying the plant with all the water it needs, the water balance is disturbed when the plant flowers. Indeed, he was able to show that under these apparently normal conditions the percentage of solids in the plant increases; in other words, the plant undergoes some degree of dessication, to its undoubted injury. The significance of this injury will be discussed below.

5. *Formation and Maturing of Grain*

As has been stated in the preceding paragraphs, it is probable that at the time of flowering there is more or less dessication of the wheat plant and a corresponding injury. From this dessication the plant apparently is unable to recover completely, for the ratio of solids (dry weight) in the plant to water continues to increase, ultimately leading to the death of the plant. Other things being equal, the moment of death depends, therefore, first, upon the degree to which the plant has been injured at the time of flowering and, second, upon the environmental conditions prevailing in the period following flowering. If these are such as to favor an abnormally high transpiration rate, then the progressive dessication of the plant will be comparatively rapid and the survival period correspondingly short. Very hot, very dry, and very windy weather must, therefore, tend to shorten the survival period. If on the contrary, environmental conditions are such as to favor the restoration of the water balance, then dessication will be slower and the survival period correspondingly longer. Rainy, cool, humid weather, therefore, must tend to lengthen the survival period.

The length of the survival period after flowering must be an important factor in determining yields. It is obvious that if the period is long there is more time for the deposition of material in the seed than if it is short; the kernels must be larger, better filled, and plumper, with correspondingly favorable effects upon yield. Cool, humid weather during the earlier stages of ripening must be favorable for good yields, though apparently far less important than during flowering. Indeed, too much moisture toward the end of the ripening period, especially at harvest, may be unfavorable.[1]

Furthermore, the length of the survival period after flowering seems to influence the chemical composition of the grain. There is good reason to believe that the protein percentage of the wheat berry depends for a given variety, in part at least, upon the length of the ripening period.[2] It is further generally believed that in the formation of the wheat berry the nitrogenous material, or protein, is laid down in greater proportion than the starch in the earlier portion of the period in which the berry is formed. In the later portion relatively more starch is laid down.[3] Indeed, for a given wheat variety, the total amount of starch so stored seems to be far more a function of the length of the survival period than is the total amount of protein. Grain that is hastened toward maturity or stopped from reaching maturity, as by an early frost, is liable to contain a relatively high percentage of protein and a relatively small proportion of starch. Such grain is liable to be small-kerneled, shrunken, or shriveled. On the other hand, if the survival period is long, there is ample time for the maximum of starch to be deposited in the grain. The kernels, while containing very nearly the same absolute amount of protein, show a lesser percentage because there is so much more starch in them. They are liable to be relatively large, plump, and well filled. Naturally, such grain is heavy and the yields are correspondingly large.

We have seen, then, that the character of the grain and the weight of it produced are, among other things, a function of the length of the survival period. We have also seen that the length of this survival

[1] Cf. Hooker, *op. cit.*, 1907; also under "Formation of the Seed," above, p. 13.

[2] F. W. McGinnis and G. S. Taylor, "The Effect of Respiration upon the Protein Percentage of Wheat, Oats, and Barley," *Journal of Agricultural Research*, 1923, XXIV, 1041; also Thatcher, *op. cit.*

[3] However, W. E. Brenchley and A. D. Hall believe there is a continuous flow of nitrogen into the berry to maturity ("The Development of the Grain of Wheat," *Journal of Agricultural Science*, 1909, III, 195 ff.), and suggest that the nitrogen percentage depends upon the amount of carbohydrate lost by respiration. However, McGinnis and Taylor (*op. cit.*) have shown that such losses are too small to be determining.

period is in large measure a function of the injury done the plant at the time of flowering and in lesser degree a function of conditions afterward. Hence the period of flowering is a very critical one for the plant; and the length of time a given variety is able to survive after flowering in any given locality is a most important characteristic since it affects yields.

Critical Periods

There is, then, perfectly definite evidence established by physiological experiments to show that there are at least two important critical periods when the weather should be more important than at other times. One is the period of germination and formation of the first leaf; the other is the period of flowering. Statistical studies of various sorts and of varying degrees of excellence, that have aimed at the investigations of the relation of weather and crops, either indicate that in fact at these times weather influences are especially pronounced or else are not inconsistent with the expectations one would entertain on physiological grounds. Much of the statistical evidence as such would hardly justify this conclusion because of the limited value of the methods used, but the statistical evidence, supporting, as nearly all of it does, the experimental evidence, indicates that we have to deal with real phenomena of practical importance.

That two critical periods have been recognized for wheat does not signify that there are no others and least of all that the weather is a matter of indifference except at the critical periods, but merely that deviations from the optimum must be much greater at other than these two critical periods to affect yields greatly.[1] Thus in Ohio neither the precipitation throughout the season nor the temperature in the fall or summer seems to be a determining factor for winter-wheat yields; whereas a warm March has a most decisive, favorable influence,[2] and a late snowfall is injurious.[3] No similar correlation has been obtained in other states. Indeed, the reputed favorable effect of a snow covering during the winter months seems to be much less important than is commonly believed, at least in many sections of the United States.

Which of the two known critical periods of the wheat plant is the more important possibly depends on local conditions. Where the summer is usually cool and humid and the fall often too wet or too dry or too cold or too warm, the germination period seems to be the more critical. Where the summer is often hot and dry the plant seems to be exposed to the greater hazards at the flowering period. In some regions there is little to choose in regard to the hazards of either period. Where seeding and flowering time present nearly optimal conditions neither period may seem critical. Rather will some other period seem more important.

The term "critical period" needs now to be considered critically. The concept seems to be due to Russian investigators who first gave it precise form, though the general idea is of course an old one.[4] Broonoff, Gauer, and Parlman seem to have been responsible for introducing the concept in a practical way. Unfortunately the term is used loosely in two rather different ways: sometimes it refers to a definite stage of the plant's development; sometimes to a definite calendar date. The term should really be used only to designate the critical period of the plant's development and not a calendar period, for a calendar period is fixed, whereas the date on which a plant reaches a critical period of its development is not.[5] The confusion that arises from lack of realization of the difference between these two concepts has been a serious handicap to the scientific development of forecasting. It would be desirable to

[1] Cf. R. H. Hooker, "The Weather and the Crops in Eastern England, 1885–1921," *Quarterly Journal of the Royal Meteorological Society*, 1922, XLVIII, 134 ff.: "Sometimes a very big excess or deficiency at a somewhat less important period can overweigh a small deviation at the normally critical period."

[2] T. A. Blair, "A Statistical Study of Weather Factors Affecting the Yield of Winter Wheat in Ohio," *Monthly Weather Review*, 1919, XLVII, 841 ff.

[3] Smith, *op. cit.*, 1920, p. 262; also "Effect of Snow on Winter Wheat in Ohio," *Monthly Weather Review*, 1919, XLVII, 701 ff.

[4] Mawley, (*op. cit.*, p. 74), for example, writes, "There are two critical periods when fine weather is of the greatest importance [to wheat]; the first when it is coming into flower, and the other at harvest time."

[5] Cf. Connor, *op. cit.*

have two different terms for the two concepts, say "critical stage" and "critical time" (pentad, decad, or month). Hereafter, the term "critical stage" will be used.

Weather Factors at Non-critical Stages

Except where weather factors are near the optimum at critical stages, as in the case of winter wheat in Ohio cited above, the weather conditions must be rather severe at non-critical stages to exert anything like the influence that is exerted by much less severe weather at the critical stages.

Under some circumstances extreme weather may act indirectly either by favoring disease or insect attack or by some form of mechanical injury, rather than by direct action upon the vital processes of the plant. Thus in some sections abnormally wet weather before heading may be injurious by favoring rust attack—whether by creating favorable conditions for the fungus or lowering resistance of the plant physiologically is not yet quite certain.

Furthermore, in some regions the character of the winter weather is important to winter wheat, but this may be due in large measure rather to physical conditions that lead to winterkilling than to a physiological reaction of the plants.

Winterkilling may be caused by any one of four factors: heaving, smothering, freezing, and physiological drought. *Heaving,* which is common in the eastern United States, is due to alternate thawing and freezing; the soil expands, lifting the plants so that the roots become exposed. *Smothering* occurs when the ground is covered with an ice sheet. *Freezing* is most apt to occur when a mild spell is followed by a sharp, severe drop in temperature. *Physiological drought* occurs sometimes in winter because plants are unable to preserve their water balance. In cold weather the humidity is low and the air is very dry. At the same time the ground may be frozen, so that the moisture is not readily available.[1]

It is not proposed in this study to enumerate and analyze all the weather factors that may affect yields at non-critical stages —many of them are not understood. A few of them have been set forth largely as examples.

IV. SOME INTERRELATIONS OF GROWTH FACTORS

Liebig's Law of the Minimum

The occurrence, at least in theory, of optimum growing conditions raises certain interesting questions in regard to the nature of optima and of limiting factors. Liebig many years ago propounded his law of the minimum for those constituents of the soil that the plant uses. This law runs to the effect that the growth of plants is limited by that mineral ingredient of the soil necessary for growth which is present in least amounts. If a single mineral ingredient is available in inadequate amount it is this ingredient that determines growth even though all other ingredients be present in surplus.[2] Liebig's law of the minimum no longer commands quite the respect it formerly did, now that more is known concerning soil flora and fauna and concerning the occurrence in soils of substances toxic to plants. Indeed in certain respects its validity has been challenged.[3] Whatever the justification for the questioning to which Liebig's law has been subjected in recent years, the law does express a general truth, viz., that there are individual limiting factors for crop development. This is probably merely a special case of the universal biologic law of the threshold: an organism does not react to an environmental factor until that factor reaches a certain dimension, whether in intensity, in quantity, or what not.

[1] J. Warren Smith, *Agricultural Meteorology, The Effect of Weather on Crops* (New York, 1920), p. 209.

[2] Justus von Liebig, *Die Chemie in ihrer Anwendung auf Agricultur und Physiologie. Zweiter Theil, Die Naturgesetze des Feldbaues.* Achte Auflage (Braunsschweig, 1865), p. 223, "Ein jedes Feld enthält ein Maximum von einem oder mehreren und ein Minimum von einem oder mehreren anderen Nährstoffen, mit diesem Minimum, sei es Kalk, Kali, Stickstoff, Phosphorsäure, Bittererde, oder ein anderer Nährstoff, stehen die Erträge im Verhältnisz, es regelt und bestimmt die Höhe, oder Dauer der Erträge."

[3] E. A. Mitscherlich, "Das Wirkungsgesetz der Wachstumsfaktoren," *Landwirthschaftliche Versuchstationen,* 1921, XCIX, 133.

Limiting Factors of the Weather

Liebig propounded his law for the mineral plant foodstuffs in the soil. Undoubtedly, it holds as much for other environmental factors as well, the factors that in their totality make up the climate and the weather. And so agricultural meteorologists are fully justified in writing of limiting weather factors. It is obvious that there must be a lower limit of soil moisture below which seeds will not germinate. There must be a lower limit of rainfall below which a zero yield is obtained. These considerations of limiting factors are important in the statistical treatment of crop and weather data, as is pointed out in a subsequent section.

Liebig recognized that growth is the resultant of many factors. Increasing the minimum factor is effective in increasing yield only up to the point at which this factor is now present in correct proportion to the other necessary factors. If increased above that level, then these added increments are without favorable effect. Some other factor has now become the minimum.[1] Conversely, decreasing a given factor has a similar effect, for it may change the factor that is minimum. A striking example of an indirect effect of this kind has been demonstrated by Fisher[2] who found that excessive rainfall acts upon wheat in England principally by removing nitrates from the soil and somewhat by favoring the growth of weeds. The effect of rainfall there is dependent, in consequence, upon the amount of nitrate in the soil, i.e., upon the state of fertilization.

It follows further from these considerations that it is altogether unlikely that yields are directly proportional to increase in any single factor. The effect of each factor is modified by the character of the rest. It is questionable, therefore, whether, as a practical matter, one is ever justified in speaking of an optimum condition for crop production as a fixed and absolute constant. If the effect of each environmental factor is in part a function of all the other factors that make up the environment, then the optimum for that factor must be a variable. One is, therefore, not justified in saying that the optimum rainfall for wheat is so many inches; one is justified only in saying that for the average conditions prevailing in a given region the optimum rainfall is thus and so.

That there can be strict proportionality only over a very narrow range of variation of a single factor has also important implications for the statistical analyses of crop yield and weather data, as we shall see. There is abundant evidence in the literature that strict proportionality between variations in weather factors and variations in crop yields is not necessarily found. The fact that relatively large changes about the optimum have relatively small effects is such evidence. Hooker has pointed it out for weather conditions in England as they affect wheat.[3] Another case in point is the statement of J. Warren Smith[4] that in the corn belt there is a critical July rainfall value of about 3 inches. If the rainfall is much less than 3 inches a small increase does not increase the yield of corn (maize) nearly as much as the same increase when the rainfall is already 3 inches or more.

A further complication that arises from the lack of direct proportionality in the response of plants to quantitative changes in individual environmental factors is that the response to deviations from the average of local weather conditions is different according as this average is close to or far removed from the optimum. The extreme case is, of course, the locality where there is always danger of crop failure. The Great Plains area of the United States and Canada is a region of this kind. Chilcott has shown definitely that in this area crop yields are not directly proportional to rainfall.[5] Barkley has reported a similar lack of proportionality for Victoria.[6]

[1] Liebig, *op. cit.*, p. 227, "Um diese Thatsachen richtig zu verstehen, musz man sich daran erinnern, dasz das Gesetz des Minimums nicht für einen Nährstoff allein, sondern für alle gilt; wenn in einem gegebenen Falle die Ernten an irgend einer Frucht, begrenzt sind durch ein Minimum von Phosphorsäure im Felde, so werden die Ernten steigen durch Vermehrung der Phosphorsäuremenge bis zu dem Punkt, wo die zugeführte Phosphorsäure im richtigen Verhältnisse steht zu dem jetzt vorhandenen Minimum an einem anderen Nährstoffe."

[2] Fisher, *op. cit.*, 1921.

[3] Hooker, *op. cit.*, 1922.

[4] J. Warren Smith, "Agricultural Meteorology," *Proceedings of the Second Pan American Scientific Congress.* Section II, Astronomy, Meteorology, and Seismology, 1917, II, 75 ff.; *Agricultural Meteorology, The Effect of Weather on Crops* (New York, 1920), p. 153.

[5] Chilcott, *op. cit.*

[6] H. Barkley, "Climatic Controls and World Prices," *Wheat and Grain Review* (Melbourne), 1927, VII, 8 ff.

The varying response of the wheat crop to changes in weather factors in different climates is illustrated by the results obtained in a preliminary study of the correlation of yields and rainfall in the state of Kansas, which, while not definite enough to justify positive conclusions, is suggestive.[1] In eastern Kansas the annual rainfall ranges, roughly, from 30 to 40 inches; in central Kansas from 20 to 30 inches; in western Kansas from 15 to 20 inches. Statistical analysis of weather and yield data for eastern Kansas indicates a tendency to excessive rainfall with detrimental effect on the yield especially when the May and June precipitation is increased. In central Kansas, on the contrary, increased rainfall tends to be favorable, except in June.[2] In western Kansas when suggestive results were obtained they tended to show that increased rainfall was at no time unfavorable and that it was usually positively favorable. This is in harmony with the conclusions of others from field experiments. Call and Hallsted find moisture the limiting factor in the production of wheat in western Kansas.[3] The most important single factor is the amount of available soil moisture at seeding time, though this does not alone insure a good crop because of the not infrequent occurrence of drought and hot, dry winds in spring and summer.

Importance of Phenological Records

As has been pointed out above, plants pay but little attention to the calendar; they germinate, blossom, ripen their seeds according to the season, not according to the calendar. The progress of the seasons is different from year to year and from locality to locality, so that seeds germinate, flowers bloom, and fruits ripen on different dates in different places and in different years at the same place. To be sure, there is an average date in each locality for each phenomenon, but in a given region in a given season the deviation from the average date may be considerable. That branch of agricultural meteorology concerning itself with the determination of data of this kind is known as phenology. The importance of keeping phenological records can hardly be overestimated and the necessity for the expansion of this sort of work by the United States Department of Agriculture and the several colleges of agriculture cannot be urged too strongly.[4]

Unfortunately, comparatively little is known of the average dates when crop plants enter upon their different stages of growth in the different regions of the United States or of the deviations from the average dates from year to year. Agricultural meteorologists in studying the relation between crop records and weather records are compelled to compare the weather at certain dates rather than at certain stages of a crop's development. Often these comparisons are made by months or weeks, but these are wholly arbitrary divisions which need not necessarily correspond to any physiologically circumscribed period of plant growth. As we have seen, critical stages may be of quite short duration. In such cases, much more numerous data are necessary for the recognition of effects, if the weather is analyzed month by month, than if short periods are taken. Even ten-day periods or weeks may prove too long intervals for clear results if the critical stage happens to begin at the end of one period and to last into the beginning of the next.

When phenological data are not available, it is sometimes possible to compensate for their lack on the assumption that if in a given year the season is late, plants will bloom and ripen seed at a later date than the average, and that, conversely, if the season is early, plants will bloom and ripen seed earlier than the average. If one knows from weather records how much earlier or later, as the case may be, the seasons have been in the different years, one can apply appropriate corrections to the dates at which the weather factors are correlated with yields. An index of earliness or lateness of the season that may be employed for this purpose is the last killing frost in spring. If one also knows the average daily

[1] This unpublished study was made at the Food Research Institute by Susan Burr.

[2] H. B. Laming, as stated by J. Warren Smith (*op. cit.*, 1920, p. 206), however, obtained results in correlating rainfall and wheat yields in central Kansas that are less easily understood.

[3] L. E. Call and A. L. Halsted, *The Relation of Moisture to Yield of Winter Wheat in Western Kansas* (Kansas State Agricultural College Agricultural Experiment Station Bulletin No. 206), May 1915.

[4] More attention is now being paid to the keeping of such records in the U.S. Department of Agriculture. Cf. Callender, *op. cit.*

temperature rise in the spring months, one is in a position to apply a correction for earliness or lateness of the season. Thus, in Utah the average temperature rise is about one degree every four days in March and April and one degree in three and one-half days in May. On this basis, starting from the date of the last spring frost, the earliness or lateness of the season might be calculated and appropriate corrections applied to the dates through the growing season.[1] Another method of correction might be developed from a consideration of whether the accumulated temperatures (see p. 28) are above or below the average. However, such corrections are rarely made in published scientific studies on the relation of weather to crop yields. In view of this, and, among other things, of the fact that the correlations are made with calendar dates rather than with stages of plant growth, it is difficult to harmonize all the findings of investigators concerning the effects of weather on a given crop.

Reasons for Conflicting Results

The considerations presented in this section give the key to the puzzle presented by the conflicting statements of competent scientists that their findings indicate that this or that set of weather conditions in this or that month are favorable or unfavorable to high yields in this or that region. These conflicts arise from the facts that calendar dates do not correspond to the same stages of growth from year to year; that optima are probably variable from year to year; that optima are different in different climates; that the responses to environmental variations are not necessarily quantitatively proportional; that responses vary according as conditions of growth are close to or far removed from the optimum. One is not justified, therefore, in saying that wheat demands a specified climate; rather one is justified in saying that wheat thrives in a certain rather wide range of climates. To bring together all the statements that have been made concerning the climatic requirements of the wheat plant is, therefore, of little value and will not be attempted in this study. To do so would lengthen this paper needlessly and would contribute comparatively little to the reader's understanding of the subject, if indeed it did not confuse him.

V. METHODS OF FORECASTING YIELDS FROM THE WEATHER

There are two different types of data that may be used to forecast yields from the weather: data obtained by experiment and data obtained by experience. The former are derived from exact scientific experiments upon the reaction of plants to weather factors. The latter are the weather and crop data of the past, and the yield to be expected in a given year with given weather is deduced by statistical methods from the experience of the past. One might be called the experimental method; the other the statistical method. The two methods are at once corrective of and supplementary to one another. Naturally, the distinction between them is not sharp. Every experiment is an experience, and data obtained by experimental methods often require statistical analysis in order that valid conclusions may be drawn from them.

[1] Alter, *op. cit.*, p. 17.

[2] It must, however, be borne in mind that the optimum environment for the plant is not necessarily best for farm operations.

Experimental Methods

The experimental methods endeavor to establish the laws that govern the growth of plants, for if these be known, the reaction of the plant to any environment is known. If the laws were known that govern the growth of the crop plant—the optimum supply of foodstuffs, of light, of moisture, of warmth; the reactions to deviations from the optima at each stage of development; etc., etc.—it would only be necesary to ascertain what the environment has been up to the time at which the forecast is made and the prophecy becomes a simple matter of computation.[2] The principal uncertainty in such a prophecy would be the possibility that during the remainder of the growing season the weather might not be optimal. The prophecy would thus be subject to a probable error ascertainable with considerable exactness from the weather records over a series of years past. The nearer the date of prophecy to the date of harvest, the smaller would this probable error be.

There are two methods that may be used to discover the laws of growth of plants. One is to grow the plant in the same locality for many years, recording carefully at the same time in detail when it passes through its different stages of development and finally recording the yield. Coincident with these observations, careful, detailed records are made of the environment, such as rainfall, temperature, hours of sunshine, wind velocity, humidity of the atmosphere, soil temperature, soil moisture. After such records have been kept for many years, yields are compared with the environmental conditions prevailing at different stages of growth and conclusions drawn concerning the kind of conditions that accompany large or small yields. These conclusions may be made the basis of forecasting. This method might be called the method of field experimentation.

The second method might be called the method of laboratory experimentation. The plants are grown under perfectly standard, controlled conditions so that the environment is known in all its factors from germination to seed formation. Throughout, observations and measurements are made upon the plants and the yield determined. If conditions are kept constant and optimal during the entire period, one is enabled to discover the normal rate of growth and one is able to plot that rate as the growth curve. If conditions are kept optimal and constant except for one factor, say soil moisture, which is made to vary, one is able to determine how soil moisture affects rate of growth and yield and one is able to fix the lower and upper limits of soil moisture below or above which, respectively, the plant is injured. And this may be done similarly for every other known growth factor.

The laboratory method has the advantage that it does not take decades to learn many of the fundamental laws that govern the growth of plants. It has the advantage that it enables one to determine what influence each of the many factors, the totality of which is the environment, has upon the plant. It has the disadvantage that it is doubtful if it is possible to reproduce in the laboratory exactly the conditions in the field, such as, for instance, crowding, the soil flora and fauna, insect, worm, and fungus attacks.

The field experiment method has the advantage that the plants are grown very nearly under the same condition as in large-scale crop production. It has the disadvantage that it is decades before one can have confidence in the results. It has further the disadvantage that since the range of variability of environmental factors in any one locality is restricted, field experiments must be carried on in many localities over a wide expanse of territory. Again, it has the disadvantage that since there is so large a number of variables in the environment it is extremely difficult to tell which of the many factors was responsible for the result.

Unfortunately, to discuss the method of forecasting yield from a thorough knowledge of the plant's reaction to its environment is as yet largely academic, since there is hardly a crop plant, the life history of which, so far as its laws of growth are concerned, is thoroughly known. The method is discussed here, nevertheless, in the hope of stimulating plant physiologists to concentrate more than they are now doing upon the study of the laws of growth of the more important crop plants; for this method, of all those that have been proposed, furnishes the most logical and the most accurate basis for forecasting. Probably thoroughly reliable methods of crop forecasting will not be achieved until research upon the physiology of crop plants has given us fairly complete information concerning their life history.[1] It may seem a long way 'round to achieve success by this route, but perhaps it will be found to be the shortest road in the end. This is not to be taken to mean that we know next to nothing about the effects of weather upon crops. The meteorological requirements of a number of crops are more or less well known but this in itself does not furnish a deep insight into their laws of growth. If growth laws were known the reasons for certain meteorological requirements would be known both qualitatively and quantitatively.

Though the laboratory method gives the more basic information it has been em-

[1] Engledow and Wadham (*op. cit.*, p. 287), in discussing breeding for high yields, express the opinion that a successful analysis of growth would afford an analysis of yield and that it is quite patent that yield must continue to be imperfectly understood so long as growth remains unanalyzed.

ployed much less frequently than the field method. The reason is simple: it requires highly trained scientists and quite elaborate equipment. Field experiments on the contrary may be conducted without the help of a highly trained personnel. Highly trained scientists are needed only for general supervision and for the analysis of the data. Moreover, field experiments serve certain immediate practical purposes and it is for such purposes rather than for forecasting that they have commonly been performed.[1] It is not astonishing, therefore, that the normal growth curves of crop plants are but imperfectly known. For the Hard Federation variety of spring wheat it has recently been determined at the Food Research Institute.[2] The extension of work of this kind is of extreme importance as certain to furnish in the end a scientific basis for forecasting. It should be undertaken by governmental agencies.

Despite the many practical uses, other than forecasting, to which the results obtained by the field experiment method may be put, there are but few countries in which this method has been exploited adequately. It is true that in very nearly every agricultural experiment station in the world small plots of crop plants are grown and carefully observed while at the same time weather records are kept. Mostly, however, the experiments have other purposes than to contribute to the improvement of methods of forecasting. The data have rarely been used for this purpose, although at times they have been published in sufficient detail to be inherently useful for this end. To be useful for the development of methods of forecasting, field experiments should be continued under the same experimental conditions for many decades. There are very few places in the world where this has been done; possibly Rothamsted is the only place, and even there the primary purpose was to determine the effects of continuous cropping and of fertilizers. The collection of meteorological data, at any rate during the earlier years, seems to have been limited to the more simple measurements.[3] Even so the experiments yielded interesting results suggestive for forecasting purposes;[4] but it was not until 1925 that the data were subjected to adequate analysis[5] that showed brilliantly not merely the results that may be achieved by statistical methods but also the fundamental value of long-continued field experiments.

Fundamentally important as the English investigations have turned out to be, it was in Russia, apparently, that field experiments designed to furnish information useful in forecasting were first deliberately inaugurated with the authorization of the Russian Bureau of Agricultural Meteorology in 1894 under the directorship of P. Broonoff.[6] This Bureau began operations in 1896 and by 1912 had 81 different stations where meteorological records were being kept near to test plots of growing crops. R. W. Mills began investigations of a similar character in Canada in 1915.[7] Our own Department of Agriculture planned to establish a similar program of research in 1914, but first the war and later the administration's policy of economy prevented the appropriation of adequate funds to make such a vitally important national program possible.[8] Very recently some phenological investigation has been begun,[9] but the work of the Department, though of very great value, hitherto has had to be limited very largely to the use of the statistical method (see below). The situation should be remedied speedily, since results from field experiments are obtainable only after observations have been made over a long period of years. The Rothamsted series has extended over more than 60 years and is by

[1] One of these practical purposes of interest in the present connection is that the experimental plot may be regarded as a sample of the entire crop area and used in estimating the yield for a considerable area. Lawes for many years estimated the wheat yield for England with considerable success from the produce of the standard experimental plots at Rothamsted; as the produce here was over or under the average, so it was assumed would be the general produce of the country (A. D. Hall, *The Book of the Rothamsted Experiments* [London, 1917]).

[2] Van de Sande-Bakhuyzen, *op. cit.*, 1928 (II); H. L. van de Sande-Bakhuyzen and C. L. Alsberg, "The Growth Curve in Annual Plants," *Physiological Reviews*, 1927, VII, 151 ff.

[3] Mawley, *op. cit.*, p. 82.

[4] Lawes and Gilbert, *op. cit.*

[5] Fisher, *op. cit.*, 1921.

[6] P. Broonoff, "The Meteorological Bureau and Agricultural Meteorological Stations Directed by the Bureau in 1901," *Memoirs of Agricultural Meterology* (Petrograd), 1901, No. 1.

[7] R. F. Stupart and R. W. Mills, "Meteorology in Canada in Relation to Agriculture," *Bulletin of Foreign Agricultural Intelligence* (Canada), 1916, VI, 307.

[8] Cf. Kincer, *op. cit.*, 1924.

[9] Callander, *op. cit.*

no means as long as statisticians deem desirable. Therefore, every year's delay in making a beginning means a delay in obtaining results because the data for that year are lost and can never be used.

Statistical Methods

The statistical approaches to the forecasting of crop yields have been of two sorts. One approach to the problem is to forecast the weather for longer or shorter periods in advance under the assumption that the probable character of the crop depends at least in a general way upon the future weather. The other approach is to compare weather conditions of past years with crop yields of those years and from these data to develop mathematical formulae by which the most probable yield may be forecast for any given set of weather conditions in a given locality.

1. *Long-Range Weather Forecasting*

The first approach has been made by statisticians, economists, and meteorologists in endeavoring to establish weather cycles. H. L. Moore has proposed an eight- and eleven-year cycle,[1] Sir Napier Shaw, an eleven-year cycle,[2] and Sir William Beveridge, a sixteen-year cycle.[3] Earlier authors have proposed still other cycles. Some cycles were derived from meteorological or related data, others from crop yields, and still others from economic data, such as series of prices. The mathematical technique most frequently used for the treatment of the data is known as harmonic analysis and the graphic presentation of the results of this kind of analysis is known as a periodogram. The method implies the possibility of long-range weather forecasting, in which numerous competent meteorologists at present have little confidence. The method is, nevertheless, alluring because the "establishment of cycles or periods whereby an indication could be given of probable yield far in advance, even within rather wide limits of accuracy, either in a given area or for the world at large, would be an achievement of the very highest importance."[4] No other method holds out hope that crop yields may be predicted far in advance of the planting of the crop. It is discouraging, therefore, to find that a considerable number of cycles have been announced. Until general agreement has been reached in regard to which of them is significant, it is obviously hopeless to expect that this method can be used in a practical way in forecasting.

The forecasting of the weather even for shorter periods, say a year, would be tremendously helpful, especially to farmers. If it were possible to know in the fall what type of weather was likely to prevail in the following summer, farmers would be able to contract or expand their fall-sown acreage accordingly. If it were possible to foretell in the spring the probable general character of the coming summer, farmers would be able to shift their crops to those most suitable to that type of summer. It is interesting to note that a good deal of research has been carried on with this end in view, and although it has not yet led to very tangible results, the outlook is far from hopeless. Okada, for example, has endeavored to establish a relation between the temperature in the winter and spring in the Aleutian Islands and the summer weather in northern Japan, August being the critical month in that country for the rice crop.[5] Several other studies are based on the assumption that ocean temperatures must profoundly influence climates and weather —an assumption by no means unreasonable. It is not impossible that progress in this sort of weather forecasting may result ultimately from progress in the science of oceanography. It is not illogical to imagine that better knowledge of ocean temperatures, ocean currents, and the like, and of the factors that control them, may lead to better forecasts of the weather. However, even if weather forecasts of this type should become possible or if definite weather cycles should ultimately be established, the crop forecasts that might be based upon them

[1] H. L. Moore, *Economic Cycles: Their Law and Cause* (New York, 1914); *Generating Economic Cycles* (New York, 1923).

[2] W. N. Shaw, "The Law of Sequence in the Yield of Wheat for Eastern England, 1885–1905," *Journal of Agricultural Science,* 1907–8, II, 17.

[3] W. H. Beveridge, "Wheat Prices and Rainfall in Western Europe," *Journal of the Royal Statistical Society,* 1922, LXXXV, 412 ff.

[4] Kincer, *op. cit.,* 1924.

[5] J. B. Kincer, "Does the Formation of Abnormally Heavy Ice in the Bering Sea Cause Famine in Northern Japan. A Review," *Monthly Weather Review,* 1922, L, 582 f.

would hardly be more than general in character. They cannot be expected to be as exact as those that can be made from the weather at a critical stage especially when the critical stage is of only a few days' duration. It may become possible to forecast that a year may be bad on the average, but this does not necessarily mean that the few critical days must be bad.

2. *Short-Range Forecasting*

The second approach to our problem is the one that seems most promising, and it is the one upon which the greatest amount of attention is being focused. It is the method of statistical analysis of the crop and weather records. Any statistical method is admittedly a makeshift, used because exact experimental data or accurate field observations are not as yet available in sufficient numbers or extending over long enough periods of time. Were such data at hand, the method would be unnecessary. In other words, if there were available reasonably perfect experiments on the effects of environmental factors upon yield, the statistical method of forecasting yields from the weather would be superfluous. Statistical methods in general are unnecessary where the results of exact experiments are available. This has been put very clearly by Yule, thus: "The more perfect the experiment—the more nearly the experimental ideal is attained—the less is the influence of disturbing causes, and the less necessary the use of statistical methods. The more imperfect the experiment—the greater the failure to attain the experimental ideal—the greater is the need for statistical methods."[1]

The use of weather data to forecast yields is nothing new, but the use of mathematical procedures in this connection is modern. Before the method of correlation (see below) was introduced in meteorology the procedure employed was to count the number of cases in which the values of the two series simultaneously exceeded or fell below the respective means of the series. This gave one a general idea of the effect of variation of one variable upon the other. This method, however, is not precise since it leaves out of account the magnitudes of the deviations from the means. The method was improved by charting the variables, say yields, against rainfall or temperature at a given time, and fitting a straight line or a curve to the data if inspection of the chart indicated a relationship between the variables. From the curve or from the equation expressing it could be determined the probable values of one variable for all possible values of the other.

In the meanwhile a new method, the method of correlation, had been developed by mathematicians and biometricians, notably Karl Pearson. This method has for its purpose to express by means of a number, called the correlation coefficient, designated by the symbol r, the degree of interdependence that exists between two phenomena; and also to develop a formula, called the equation of regression, to enable one to determine with a high degree of probability one phenomenon from the other. This method was first applied to crop-yield forecasting by Hooker[2] in 1907. Jacob, working isolated in India,[3] used the same method in 1910 without knowledge of Hooker's paper. Since that time it has become the method most generally employed for studying the interrelation of crop yields and the weather.

It is not necessary to explain in this paper the mathematical technique of the method, since it is fully treated in standard textbooks on statistics.[4] It is necessary, however, to point out what are the weather phenomena that are most frequently compared with yields over a series of years in

[1] G. U. Yule, *The Function of Statistical Method in Scientific Investigation* (H. M. Stationery Office, London, 1924), p. 3. Jacob (*op. cit.*, 1916, p. 132) expresses the same thought: "the yield of each crop per acre . . . . is a statistical problem only because of its complexity; and the more physical and biological laws can be applied to it, the smaller will be the unexplained residual effects to which it will be necessary to apply statistical methods.

[2] R. H. Hooker, "Correlation of the Weather and Crops," *Journal of the Royal Statistical Society*, 1907, LXX, 1 ff.

[3] S. M. Jacob, "On the Correlation of Areas of Matured Crops and Rainfall and Certain Allied Problems in Agriculture and Meteorology. (A preliminary enquiry)," *Memoirs of the Asiatic Society of Bengal*, 1907–10, XI, 347.

[4] G. U. Yule, *An Introduction to the Theory of Statistics* (London, 1911). For readers who require more complete explanation of the mathematical methods than is given by Yule, numerous more elementary texts are available. Among these, F. C. Mills' *Statistical Methods Applied to Economics and Business* (New York, 1924) may be mentioned as containing sections on abbreviated methods of computation and on curvilinear correlations, not included by Yule.

calculating correlation coefficients and in developing equations of regression. The most frequently employed weather factors are rainfall and temperature. The reasons for selecting these are not merely their obvious influence upon crops, which in some of its aspects have been discussed in a preceding section, but also the ease with which they are measured. Sometimes sunlight is also used, but its measurement is not easy, and long series of sunlight measurements are available for but few localities. Investigators have had to content themselves as a rule with counting the number of hours of sunshine on the days in question.

Selection and Adjustment of Data

Crop yields and weather data are rarely used as such in calculating correlation coefficients or developing regression equations. Most commonly deviations from the normal are employed, as, for example, deviations of yield from the normal for the region, as compared with deviations of the mean temperature or of the rainfall from the normal.

Various devices are used to take account not merely of total rainfall, but also of its distribution. Weighting is applied according to the number of days rain fell, or according to the number of days with given amounts of rainfall.

Rain may be measured; from the number of inches recorded by a rain gauge, the number of tons of water falling upon an acre may be calculated. Heat can less easily be measured in this way; thermometer readings cannot be converted into a value corresponding to inches of rain or tons of water. Yet a value for temperature corresponding to the rainfall of a period is required for purposes of correlating temperature with yields. Such a value is obtained by computing the accumulated temperatures for the period, i.e., the sum of the excesses of the mean daily temperatures for the period over the minimum temperature permitting growth. For wheat this minimum temperature may be taken as about 6.1°C. (43°F.). For sugar cane Walter took the temperature as about 21.1°C. (70°F.).[1] Of course, for purposes of calculating the correlation coefficient from deviations from the normal, it is immaterial what base line is taken. Indeed, there may be some advantages in taking a higher temperature than 6.1°C. (43°F.) for a crop like wheat, say 15.6°C. (60°F.), since smaller numbers are obtained for the deviations that facilitate computations. Kincer[2] has suggested that for spring-seeded crops the mean daily temperature at the average date of beginning planting be taken as the base. This temperature is very nearly the same everywhere for a given crop, though the day in the spring when this temperature is reached is different in different latitudes and at different altitudes. The use of daily mean temperatures introduces errors where the length of day and night are very unequal, as was long ago pointed out by Buchan.[3]

It has also been proposed to weight the temperature data in some manner to take account of Van't Hoff's Law (see p. 7) under the assumption that it holds for the growth of plants. It has, further, been proposed to weight the temperature data in some manner to take account of certain physiological effects of warmth determined by experiment.[4] Since, in sunshine, the leaf temperature is higher than the air temperature, it has been proposed to deduce the leaf temperature from the air temperature and to use the value so obtained instead of the air temperature.[5] This suggestion brings into the correlation the sunshine factor.

The list of procedures, either used or suggested, to be applied to the data before the actual calculation of the correlations or equations is undertaken might be greatly enlarged; but it is sufficient to point out in this place that the results obtained showing the average effect of a single factor, for example, rainfall, upon the final yield shows also the effect of the average weather as-

[1] A. H. Walter, *The Sugar Industry of Mauritius. A Study in Correlation, Including a Scheme of Insurance of the Cane Crop against Damage Caused by Cyclones* (London, 1910), p. 62.

[2] Cf. Smith, *op. cit.*, 1920, p. 67.

[3] *Quarterly Report of the Meteorological Society of Scotland,* June 30, 1862, p. 2, cited by H. Mellish, "Some Relations of Meteorology with Agriculture," *Quarterly Journal of the Royal Meteorological Society,* 1910, XXXVI, 77 ff.

[4] B. E. Livingston, "Single Index to Represent both Moisture and Temperature Conditions as Related to Plants," *Physiological Researches* (Johns Hopkins University), 1916, I, 421 ff.

[5] D. A. Seeley, "Relation between Temperature and Crops," *Monthly Weather Review,* 1917, XLV, 354.

sociated with the rainfall and includes all contributory causes so associated. In view of the complexity of crop growing, it is practically impossible completely to segregate a single factor, nor indeed would this be of practical importance. It would seem advisable, therefore, to select for correlation studies and crop forecasting purposes that environmental factor which is the resultant of or associated with the greatest number of other environmental factors. In semi-arid regions it may be better to use evaporation from a free-water surface than precipitation, for evaporation is the integration of several other important factors, such as temperature, wind velocity, and relative humidity.[1] Still better, of course, would be the multiple correlation (see below) with evaporation and precipitation. Better still should be the correlation with soil moisture, for this is the resultant of the character of the soil, the precipitation, and the evaporation both from the surface of the soil and the surface of the crop's leaves. It is not impossible that better forecasts could be based on soil moisture than upon precipitation; but, so far as the writer is aware, this does not seem as yet to have been attempted.

Significance of the Correlation Coefficient

The finding of a statistically significant correlation coefficient does not in itself justify the conclusion that the two phenomena for which the coefficient has been found are therefore directly causally related. Yule has the following pertinent remarks to make on reasoning of this type:[2]

> "You can prove anything by statistics" is a common gibe. Its contrary is more nearly true—you can never prove anything by statistics. The statistician is dealing with most complex cases of multiple causation. He may show that the facts are in accordance with this hypothesis or that. But it is quite another thing to show that all other possible hypotheses are excluded, and that the facts do not admit of any other interpretation than the particular one he may have in mind.

[1] Chilcott, *op. cit.*, p. 83.
[2] Yule, *op. cit.*, 1911, p. 4.
[3] Cf. March, *op. cit.*
[4] Fisher, *op. cit.*, 1921.

It follows, necessarily, that the converse is true, i.e., that the failure to find a significant correlation coefficient does not prove that there is no relation between two variables. The finding of a significant value indicates a very high probability of a causal relationship; whereas failure to find a significant value may merely mean that an existing relationship has been masked by factors which have not been taken into consideration.

The correlation coefficient, together with its probable error, presents a quantitative expression of the probability that two variables are interdependent. If there is an exact correspondence, the correlation coefficient will be either +1 or −1. For example, if an increase in rainfall always increases wheat yields by an exactly proportional amount, the correlation coefficient would be +1; conversely, if it always decreases yields by an exactly proportional amount, the correlation coefficient would be −1. A high value with a small probable error indicates that there is great probability of some direct or indirect relationship between the two variables. The reliability of the relationship depends both upon its uniformity and upon the number of times it has been observed to occur. If the correlation coefficient is not very high a considerable series of data is required to establish its significance. If, as in forecasting yields from the weather, we are dealing with time series, we will have greater confidence in the coefficients calculated, the farther back into the past the data extend. The results obtained with series as short as twenty years may be regarded as of significant value only if the correlation coefficient is above .40. For a very short period, moreover, a small probable error does not necessarily indicate that the coefficient of correlation is significant.[3] The difficulties of dealing with short series have been set forth in detail by Fisher.[4]

If the two series of variables be charted as described in a preceding paragraph, a line may be fitted to the points. The line that best fits the points is known as the *line of best fit;* it describes the average relationship between the two variables and is known as the *line of regression.* Its equation is known as the *equation of regression,*

and the quantity which gives the slope of the line is called a *coefficient of regression.* By these means it is possible to calculate the value of one variable corresponding to a given value of the other.

Significant Correlation Coefficients

And this raises the question: How large must a correlation coefficient be before one is warranted in regarding it as significant for crop forecasting purposes? J. Warren Smith believes "it probably is safest to assume that there may be some relation if the correlation coefficient is three times the probable error and the relation is established beyond question if it is more than six times the probable error."[1] Kincer, on the other hand, believes that "for forecasting purposes one of less than .80 determined from a reasonably large number of observations with a corresponding small probable error has a limited value."[2] Wallén thinks that even small coefficients may express truly real relationships if one obtains several analogous coefficients for geographically adjacent regions or for regions of the same character.[3] Jacob is of the same opinion.[4] It should be pointed out, moreover, that several investigators have had fair success in forecasting with coefficients of less than .80.

VI. PITFALLS OF CORRELATION ANALYSES

Trends of Yields

There are a number of pitfalls into which an investigator may fall in using the correlation method. One of these is that the data on yields may in themselves show a very definite trend. Crop yields in a given locality may be growing steadily smaller or larger. If the system of agriculture practiced is not rational and the soil is being exhausted, the yield trend may be going downward. If a new plant disease or insect pest is introduced or if new land is brought into cultivation, the trend of yield may be changed. This has happened in the United States for cotton with the introduction of the boll weevil and the westward extension of cotton culture. Or the system of agriculture may be improving so that yields may be rising. Or improved varieties may have been introduced with higher yield characters than the older varieties that they supplant. Or low prices may be driving the crop off marginal land, leaving only the better land yielding heavily under cultivation. Or a competing crop may be introduced which gradually drives the crop under investigation off all but the land peculiarly adapted to it. Changes in yield due to causes like the last are especially likely to occur in regions new to agriculture in which experience has not yet determined what is the best agricultural practice. However, even in long-settled countries it has been found necessary to correct the data for secular trend of yields before calculating correlation coefficients. Wallén found this necessary for Sweden, chiefly because of the introduction of improved varieties of cereals.[5] Hooker surmounted this difficulty by correlating the difference between successive values rather than the values themselves.[6] This method, known as the variate difference correlation method, is regarded by Persons as particularly unreliable for short series.[7] Wallén preferred a method based upon a proposal of Charlier's.[8] Moore eliminated cyclical

[1] Smith, *op. cit.*, 1920, p. 57.

[2] Kincer, *op. cit.*, 1924, p. 268.

[3] A. Wallén, "Sur la corrélation entre les récoltes et les variations de la température et de l'eau tombée en Suède," *Kungl. Svenska Vetenskapsakademiens Handlingar,* 1917, LVII, No. 8.

[4] S. M. Jacob, "Correlation of Rainfall and the Succeeding Crops with Special Reference to the Punjab," *Memoirs of the Indian Meteorological Department,* 1916, XXI, Part XIV, p. 133.

[5] Wallén, *op. cit.*

[6] R. H. Hooker, "On the Correlation of Successive Observations; Illustrated by Corn Prices," *Journal of the Royal Statistical Society,* 1905, LXVIII, 696 ff. Cf. "Student," "The Elimination of Spurious Correlation Due to Position in Time or Space," *Biometrika,* 1914, X, 179 f., and O. Anderson, "Nochmals über 'The Elimination of Spurious Correlation Due to Position in Time or Space,'" *ibid.,* 269 ff. Also A. Ritchie-Scott, "Note on the Probable Error of the Coefficient of Correlation in the Variate Difference Correlation Method," *ibid.,* 1915, XI, 136 ff.

[7] W. M. Persons, "Review of *Forecasting the Yield and Price of Cotton,* by H. L. Moore," *American Economic Review,* 1918, VIII, 405 ff.

[8] C. V. L. Charlier, "Contributions to the Mathematical Theory of Statistics," *Archiv för matematik, astronomi och fysik,* VIII, No. 4.

and secular influences by converting the data into percentages of the averages for the previous three years and correlating these percentages.[1] Others have correlated not the data themselves but their deviations from the average. They have corrected for secular trend by breaking up the period into several portions and using the deviations from the average of each portion. R. A. Fisher has removed secular trend by fitting fifth-degree polynomials to the yield data and using the residuals in the correlation.[2]

Some investigators have also tested for secular trend not merely yield but also weather data, such as rainfall or temperature, with varying results. For the most part they have not found trends of the weather sufficiently pronounced to demand special provision in the calculations. It will be noted, however, that the method of Moore applies such a correction, for he correlated the relatives both of yield and of rainfall.

Interrelation of Weather Factors

In studying the effect of a single weather factor, such as rainfall, on a crop at different times, one may run into spurious results because the weather in one period is correlated with the weather in other periods. For example, if a high correlation is found between rainfall in August and yield, this value may be spurious because the yield is in fact primarily dependent on September rainfall, which is itself correlated with August rainfall. Further, if the rainfalls in August, September, and October are positively correlated *inter se,* then this fact will give a spuriously high value to all correlations of yield and rainfall for any one of the months; but if, on the other hand, the monthly rainfalls are negatively correlated among themselves, the true magnitude of the crop correlations will be masked. In such cases, the partial correlation coefficients must be calculated.

The hypothetical case of the preceding paragraph is not far-fetched; indeed, meteorological phenomena are very frequently correlated. Hence, before conclusions are warranted, it is often essential to calculate partial correlation coefficients, i.e., coefficients that are corrected for the effects of other correlated variables.

If the critical periods for the crop and locality are not known and are probably short, as is usually the case, the weather data must be obtained for successive short periods. Since the data for each period constitute a separate variable, the number of independent variables becomes large. The computation of partial correlation coefficients or even of partial regression coefficients only, to measure the effect of the weather factor in each period, becomes a laborious task.[3] More important, with such a large number of variables the partial correlation and regression coefficients must usually be small and their probable error large, so that in the end nothing whatever may be really proved.

Furthermore, the method of multiple correlation may yield entirely spurious results. Quoting Fisher:[4]

> The biometrical investigations for which the method of multiple correlation was developed, differ from such agricultural studies as the present in two main particulars. In the first place the number of individuals measured was taken to be large, of the order of 1,000, or at least of some hundreds, and the special problems of distribution which arise in small samples have only recently begun to receive attention. In the second place the number of measurements taken of each individual, or the number of *variates,* was generally small, and in all cases far smaller than the number of meteorological elements which may plausibly be regarded as affecting the crop. The sequence of weather to which crop variations may be ascribed extends over a year, or even more, and consists in this country [England] of abrupt, relatively violent and transient spells, each of which has its influence on the crop. If we wished to analyze the sequence no more closely than by monthly averages, we should still have 12 values for rainfall, and 12 more for maximum and minimum temperature, dewpoint, grass minimum, solar maximum and soil temperatures, nor would it be unreasonable to include some such measure of insolation as is given by "Hours of Bright Sunshine," and averages of the direction and force of the wind.

[1] H. L. Moore, *Forecasting the Yield and the Price of Cotton* (New York, 1917), chapter iv.

[2] Fisher, *op. cit.,* 1925.

[3] J. B. Kincer and W. A. Mattice have proposed a substitute for the method of multiple correlation which is less laborious and apparently gives very nearly the same results ("Statistical Correlation of Weather Influences on Crop Yields," *Monthly Weather Review,* 1928, LVI, 53 ff.).

[4] Fisher, *op. cit.,* 1925.

The number of meteorological elements might be made to exceed even the longest series of crop records available, for the Rothamsted wheat records provide, after necessary deductions, only 60 yields. Consequently, if the computer were provided not with yield data at all, but with an equal number of values composed at random, he would still be able to express them with perfect accuracy in terms of the weather records, for the number of unknowns available would exceed the number of equations for them to satisfy.

It is of more practical importance that even when we have selected a number of meteorological variables which is less than the number of crops recorded, a strong semblance of dependence may be produced, even if fictitious data, unrelated to the weather, are substituted for the true crops.

Recognizing these facts, Fisher limited his investigation of the effect of weather on Rothamsted wheat yields to a study of the relation of rainfall to yield. Even with this restriction of scope, a very large number of independent variables would be required to determine the critical periods with precision by the usual method. Fisher surmounted this difficulty by the ingenious plan of expressing the distribution of rainfall in each year in terms of the six coefficients of a fifth-degree polynomial. He thus obtained six coefficients for each year, which he used as independent variables in place of the actual rainfall data by periods. He then calculated the partial regression coefficients. From the resulting regression coefficients, he obtained an equation in the form of a fifth-degree polynomial, showing the effect of one additional inch of rainfall at any time during the year. He holds that by this method more accurate results are obtained than by the usual method and the dates of the critical periods are located more precisely.

Even with this degree of refinement in the statistical analysis, it is most necessary for investigators who may undertake the interpretation of the results to bear in mind the fact that any given weather factor is usually very highly correlated with one or more other weather factors. Effects attributed by the statistical analysis to rainfall during a particular period may actually be due to temperature, amount of sunshine, wind velocity, or some other weather factor which is correlated with rainfall during that period.

Multiple Correlations

As has been pointed out repeatedly in the course of this study, the yield of crops is the resultant of many forces, and it would be desirable to determine the combined effects of as many environmental factors as possible. Obviously the more of such factors that may be brought into the calculation, the greater the certainty of the forecast. The method usually employed for this purpose is the method of multiple correlation, which, unfortunately, is laborious and correspondingly little employed.

Relations Not Necessarily Linear

Just as the environment is complex so is growth a complicated phenomenon. It is not a single homogeneous function but consists of many components. These are probably not all affected alike by a given environmental factor and they are probably all correlated *inter se*. For lack of knowledge, it is not possible to dissect the phenomenon of growth into its component factors and study the effect of environment upon each. Undoubtedly, were this possible, as it will be some day, it would make forecasting by statistical procedures vastly more certain. If the matter is mentioned in this connection at all, it is because it has certain bearings on the interpretation of correlation coefficients. If there is any basis for the law of the minimum (see p. 20), it follows that a favorable change in an environmental factor may be ineffective if some other factor is the limiting one. If the limiting factor is favorably changed, then the ultimate effect upon the plant must depend upon whether or not some other factor now becomes limiting.

This is no theoretical reasoning. Laboratory experiment and field observation may be brought to its support. For example, Brown has shown that the rate of assimilation in plants may be increased by increasing the partial pressure of the carbon dioxide in the air surrounding the leaves.[1] However, if this is done the result is abnormal since other factors in the plant are not, apparently, capable of adjusting themselves to the higher level of assimilation.

[1] Brown, *op. cit.*

Equally significant are the statistical deductions of J. Warren Smith[1] on the critical July rainfall value for corn to which reference has already been made. Other examples have been given in previous sections and they might be multiplied greatly.

These considerations are important because they indicate that the relations between environmental factors and yield are not necessarily linear.[2] Smith in the paper cited above gives a table (p. 79) showing the increase of yield of corn with increase of rainfall, which does not indicate a linear relation. Indeed, nothing that is known of the laws of growth gives reason to assume that a given quantum of a factor essential to the continuance of life calls forth always the same quantitative response. For animals we know that there is a level of food intake that permits only maintenance but not growth. This level must be exceeded before growth is possible. For plants we know that for each increment in leaf area there is an increment in assimilation[3] which affects necessarily the rate of growth of the whole plant. Indeed, Blackman has suggested that the vegetative growth of plants obeys the compound interest law,[4] although it has since been shown that this law does not in fact exactly express the phenomena.[5] At any rate no one has ever suggested that the curve expressing vegetative plant growth is a straight line, and it is, therefore, unlikely that the relations between growth rates and the environmental factors that condition growth are directly proportional. Concerning the laws of reproductive growth, we are much less well informed. There is, therefore, no reason to assume that the relation between environment and the plant—at least where vegetative organs furnish the harvest—is a linear function. This has been recognized by some students of forecasting.[6] A crop may fail because of too much as well as too little rain. If excessive rainfall occurs as frequently as deficient rainfall and is equally influential in reducing the yield, the correlation coefficient between rainfall and yield, calculated on the assumption of a linear relationship, will be zero. When the true form of the relationship is recognized, the relation may appear quite close. The coefficient of correlation must also be zero, theoretically, for all values of a limiting factor below the threshold. If it takes five inches of rain to produce a crop, then every rainfall less than five inches produces the same yield, viz., zero. This is, of course, an impossible case, yet there are regions enough where crop failures are not unusual, and the weight to be given such years is an important question, as will appear later in this study.

Now the correlation coefficients are commonly calculated on the assumption that the relationships are linear. The coefficient of correlation, *r*, is a measure of the degree to which two variables approach a linear relationship and it is significant only when a straight line gives a good fit to the points representing the paired values of the two variables. Hence, if the relationships between weather factors and crop yields are not linear, there may still be a high degree of correlation, even though the correlation coefficient, *r*, that is found be low. In such cases other methods of determining correlation must be used. Mills gives an example of such a case in the effect of different amounts of irrigation water upon the yield of alfalfa.[7] It is not impossible that cases of non-linear correlation may be found more often in the field of crop forecasting than linear ones.[8] If, nevertheless, some good results have been obtained with the methods of linear correlation, it is perhaps because the data analyzed may have been concentrated on so small an arc of the curve that it did not differ too much from a straight line. Furthermore, the methods for curvilinear correlation are laborious and since crop data are commonly

[1] J. Warren Smith, "Agricultural Meteorology," *Proceedings of the Second Pan-American Scientific Congress.* Section II, Astronomy, Meteorology, and Seismology, 1917, II, 79.

[2] A relationship is said to be linear when the line of best fit is a straight line.

[3] Cf. Van de Sande-Bakhuyzen and Alsberg, *op. cit.*

[4] V. H. Blackman, "The Compound Interest Law of Plant Growth," *Annals of Botany,* 1919, XXXIII, 353.

[5] See Van de Sande-Bakhuyzen and Alsberg, *op. cit.*

[6] R. H. Hooker, "Forecasting the Crops from the Weather," *Quarterly Journal of the Royal Meteorological Society,* 1921, XLVII, 82.

[7] Mills, *op. cit.,* p. 433.

[8] Cf. Mordecai Ezekiel, "A Method of Handling Curvilinear Correlation for Any Number of Variables," *Journal of the American Statistical Association,* 1924, XIX, 431 ff.

subject to a wide margin of error, it is often open to question whether it is worth while applying refined methods of analysis to a given case.

Kincer has recognized that the case in which conditions vary about the optimum requires special treatment.[1] He assumes that the most favorable conditions for cotton may be taken as a base and that any departures from these, whether above or below, whether of rainfall or temperature, are harmful. How far this assumption may be justified for all crops in all sections remains to be determined. Kincer, then, adopts certain numerical values for the harm done by rain or heat or cold, according as a plus deviation follows a plus deviation, a minus one a minus one, and so on. Thus a sequence of months with the same departure from normal is weighted as the most harmful. In addition he introduces certain slight modifications of the values to be introduced, when during several months the same conditions prevail. The values are stated "to have been fixed empirically from a general knowledge of the effect on plant development of certain combinations of weather," but what constitutes a plus, zero, or minus departure is not made clear except that 0.3 inches of rain below the normal for April or May is regarded as a minus. In this manner, Kincer works out a formula with which he obtained good results in forecasting the yield of cotton. Jacob had similarly good results for wheat in the Punjab.[2]

J. Warren Smith employed a similar principal. He regards all weather as favorable that is not plainly unfavorable. "An estimate is made of the unfavorable effects of features of the weather which are considered detrimental, and the sum is obtained of these harmful effects, which becomes the weather index of the year. . . . . From the weather index and yield value a regression equation is calculated."[3]

Treatment of Crop Failures

There is still another question that must be considered in this connection. It arises from the fact that not merely are relationships of environment and crop yield often not linear but that there are also limits beyond which no crop is possible. In other words, there is a sort of necessary threshold value for the environment. The wheat crop, for example, must fail if at certain stages of its growth there is not a certain minimum of soil moisture available. There is a threshold value for moisture which must be attained to make any growth at all possible, and there is another threshold value to make the formation of seed possible. This is perhaps only a special case of the general biological law of the threshold that living organisms do not react until the stimulus to which they are subjected reaches the threshold.[4] Every change in environment that so acts upon living substance as to call forth some change in the operation of its life processes is to be regarded as a stimulus.[5] Growth and seed production are to be regarded as affected by the stimuli furnished by the environment and, therefore, subject to the law of the threshold.

If this be true, it follows that a given increment in a necessary environmental factor must produce quite a different response according as the quantity to which the increment is added is below, at, or above the threshold value. If below the threshold value, this increment can have an effect only if it is large enough to raise the total above the threshold value; even a large increment may, therefore, have no effect at all. If the factor in question is close to the threshold value, it is obvious that even a small increment may have some effect. With increasing increments the effects become larger and then decrease until near the optimum they have little effect. These considerations present another rea-

[1] J. B. Kincer, "A Correlation of Weather Conditions and Production of Cotton in Texas," *Monthly Weather Review,* 1915, XLIII, 61 ff.

[2] S. M. Jacob, "Correlation of Rainfall and the Succeeding Crops with Special Reference to the Punjab," *Memoirs of the Indian Meteorological Department,* 1916, XXI, Part XIV, p. 133.

[3] J. Warren Smith, "Influence of Weather on the Yield of Crops," *Monthly Weather Review,* 1922, L, 567 ff.

[4] However, in certain cases, if the stimulus is close to the threshold value and is repeated there may be summation of stimuli with resulting reaction.

[5] E. Mangold, "Reiz und Erregung, Reizleitung und Erregungsleitung," *Ergebnisse der Physiologie,* 1923, XXI, 370.

son for believing that the relations between environmental factors and yields are not universally linear.

But they raise also another question concerning the treatment of data in analyzing relationships between crops and the weather in years of complete or nearly complete crop failures. Are such years to be given the same weight as the far more numerous years when the crop was either good or poor, but by no means a failure? Suppose, for example, that in a given region we have a series of 30 years of crops in which the crop was a complete failure three times because the rainfall at the appropriate season did not reach the threshold value of 7 inches. Let us assume that in one of these three years of crop failures the rainfall was 2 inches, in another, 4 inches, and in the third, 6.5 inches. Are we to treat all three years in the same way? Regarded by themselves they show no correlation of crop yield with rainfall. To include them with the years in which the rainfall exceeded the threshold value results in obscuring the real correlations that exist. To use correlation coefficients and equations of regression so obtained to forecast crops has the result of making forecasts for the years when the rainfall exceeded the threshold value much less certain than they might be if the three years were left out of the calculation or if some form of adjustment were introduced which would give to a precipitation of 2, 4, and 6.5 inches, respectively, the same significance, since they are equally effective in causing crop failure. This, however, does not seem to be the practice of statisticians, and so we encounter instances of low or not significant correlation coefficients which would become high or significant if a single year or only one or two years were omitted. Shaw proposed that such years be eliminated.[1] To this Hooker objects.[2] On the other hand, there is much to be said in favor of Shaw's suggestion. It is not a case on all fours with that of a biased chemist who suppresses the results of analyses which do not fall in line with some hypothesis he is supporting. It is more like the case of a chemist who, in determining carbon and hydrogen, finds that his combustion tube has cracked, so that he knows his result not to be valid and, therefore, rejects it.

In the hypothetical case under consideration, we know definitely from biological laws that we introduce an error by including in the series on which calculations are based the widely differing rainfall values for the years of crop failure. It seems patent that some method of adjusting the data for these years must be used to avoid error, or else that they should be left out and the resulting regression equation used only within the limits from which it was calculated. One needs no regression equation or refined mathematics to forecast a complete crop failure whenever the threshold value of rainfall is not reached. All one needs to know is what this value is. Moreover, in effect, some statisticians have been rejecting certain data because they have found, or assumed, no correlations to exist. Thus, it is the custom to take into the calculations only temperatures above 5.6°C. (42°F.) because crop plants grow little if at all at lower temperatures. Hooker, for example, could find no specially significant correlations for temperatures below 5.6°C. (42°F.); therefore he does not discuss them.[3] Walter, in correlating rainfall with the yield of sugar on Mauritius,[4] writes that "it has been considered that during excessively wet periods rainfall which increases the temperature of the soil at a depth of five feet raises the moisture-content of the soil to such an extent that a further fall, in excess of the evaporation from a free-water surface, is non-effective and has therefore been rejected." In principle, there is no difference between these procedures and the rejection of years that are

[1] "But there was one year, 1879, when there was really not enough warmth to grow a wheat crop at all in this country [England]. Practically the experiment failed, and to bring a failure of this kind, when the accumulated temperature was only numerically low, into association with other data where there was more or less proportionality, seemed to require a certain amount of justification. Is it therefore justifiable to leave out some of the specially exceptional cases? . . . . A very high coefficient obtained for all years with one or two exceptions might have a very different meaning."—Discussion of Hooker's paper, "Correlation of the Weather and Crops," *Journal of the Royal Statistical Society*, 1907, LXX, 1 ff.

[2] *Idem.*

[3] *Idem.*

[4] Walter, *op. cit.*, p. 62.

subliminal with regard to some essential meteorological weather factor.

If no assumption is made that the correlation is linear and if the correlation coefficient, *r*, is not calculated, the question what to do with the years of crop failure because some factor, say rainfall, is subliminal does not arise. In that event, some method of determining curvilinear correlation is to be employed. The appropriate curve would be one that reaches zero and becomes horizontal at the point representing the threshold rainfall value.

Hail and Hurricanes

A related question is what to do in the series one is studying with years in which there is crop failure or very great reduction of the yield because of some catastrophe like hail or hurricane, and not in any way because of the particular weather factor one is correlating with the yield. In a region where catastrophes of this kind occur, the forecast made with the aid of a regression equation thus calculated might be qualified with a statement of the probability of the occurrence of such a catastrophe as determined from past weather records. Fortunately, hail is a local phenomenon and perhaps need not often be considered when one is dealing with a large area. However, it would seem from Chilcott's observations[1] that there are regions where it is an important factor in the aggregate.

Hurricanes, on the other hand, may cover a wide expanse of territory and do not necessarily completely destroy the crop. The question then arises how to correct the yield of the hurricane years — in other words, to determine what the yield would have been if no cyclone or other catastrophe, damaging but not completely destroying the crop, had occurred. Walter, dealing with the effects of cyclones on sugar cane,[2] has developed a method for the purpose.

The justification for special treatment of the data for years in which hail, hurricane, or other catastrophe not under investigation has affected the crop is not so clear as the justification for special treatment of data for years in which the weather factor under investigation falls below the threshold. In all years there are some such special factors at work. The selection of certain cases for special treatment may readily introduce a bias into the results. Such selection is undoubtedly justified in certain cases, but care must be exercised.

The biological laws that we have been considering, the law of the minimum, the law of the threshold, the laws of growth generally, make it extremely improbable that crop growth and crop yield data have necessarily a normal dispersion,[3] that is, a chance distribution. There is every reason to believe that it cannot be normal in a climate such that there are occasional failures due to, say, subliminal rainfalls, while failures practically never occur from excess of rainfall. In such climates the average crop for a definite period that includes years of subliminal rainfall is not produced in the years of average rainfall. Indeed, the correlation coefficient, *r*, is designed to be applicable to normal distributions. Its interpretation in other cases must be made with some caution. Perhaps in the difficulties that arise from "skew" (i.e., not normal) distributions is to be sought a part of the explanation for the greater uncertainty of forecasts where fluctuations of climate are violent and extreme[4] and for the fact that a crop failure seems easier to forecast than a bumper crop.[5]

The methods developed by Fisher, to which reference has been made repeatedly, obviate many of the difficulties encountered in applying the well-known methods of total, partial, or multiple correlation to the problems of crop forecasting. They are cer-

[1] Chilcott, *op. cit.*

[2] Walter, *op cit.*

[3] If a curve be plotted of which the abscissae represent the value of the series "and the ordinates the number of times each value occurs, a 'frequency curve' is obtained. If this is of the 'cocked-hat' shape, showing a maximum at the center and tailing off symmetrically at either end, with an equation of the form

$$y = ae^{-\frac{x^2}{2\sigma^2}},$$

the frequency distribution is called normal."—R. H. Hooker, "An Elementary Explanation of Correlation: Illustrated by Rainfall and Depth of Water in a Well," *Quarterly Journal of the Royal Meteorological Society*, 1908, XXXIV, 277 ff.

[4] R. H. Hooker, "Forecasting the Crops from the Weather," *Quarterly Journal of the Royal Meteorological Society*, 1921, XLVII, 90; G. Taylor, Agricultural Climatology of Australia," *Quarterly Journal of the Royal Meteorological Society*, 1920, XLVI, 331.

[5] Hooker, *op. cit.*, 1921, p. 91.

tain to inaugurate a new era in crop forecasting by statistical procedures.

It may be objected that in the discussion here presented of forecasting wheat yields from the weather insufficient account has been taken of damage through fungus and insect attack. It is true that these are important hazards of which little account is taken in most of the statistical studies of crop forecasting. These are just a few of the many factors that for one reason or another must be left out of account until much greater progress has been made in the subject. However, the omission is not in all cases as serious as might be supposed, because the incidence of a good many of the more important fungus and insect attacks is greatly dependent upon the weather. The damage done to wheat, for example, by the Hessian fly in certain regions varies greatly with the weather.[1] The number of broods of coddling moths in a year, and therefore the damage they do to fruit trees, is a function of weather.[2] The damage done to wheat by rust is closely correlated with the weather.

VII. PRESENT RESULTS AND LINES OF IMPROVEMENT

From the perusal of the preceding sections the reader may have received the impression that the problem of forecasting wheat yields from the weather is so complicated and so beset with pitfalls as to be hopeless. Certainly the results already achieved are limited. No government as yet undertakes to forecast the yields of its own crops on the basis of weather data. Nevertheless, we may confidently look forward to improvement in methods and to increasing partial application of them. In spite of all the complexities involved, there is reason to believe that if competent investigators continue to address themselves to the problem as assiduously during the next twenty years as they have during the past twenty, the forecasting of crops from the weather—or at any rate from environmental factors—may be made at least as satisfactory as by the present subjective methods and probably much more so. At the very least, it can be made an invaluable check upon current practice. At best it should be more accurate and the forecasts more timely than with the present methods. There is reason to believe that ultimately the statistical method may displace very largely the subjective method. Certainly, it is a much less expensive procedure. Moreover, it has especial value in forecasting crops in foreign countries, either countries from which reports are received so tardily as to be of little value, or countries which do not make forecasts, or countries in which bias may be suspected.

Fisher has shown what may be done with adequate mathematical technique even though the data be limited. The yields he calculated from the rainfall data alone agreed very well with the actual yields as determined by weighing on certain fields at Rothamsted for 60 years. He found[3] that in one plot 11 per cent, and in others 40 per cent of the variance is expressible in terms of the sequence of rain records. As he puts it: "It is remarkable that so much of the variance as 40 per cent should be expressible in terms of a single meteorological element such as rainfall, especially when it is remembered that all the causes of variation without exception, including casual errors, and the quadratic terms of the rainfall effect, are included in the remaining 60 per cent. This leads us to think that a record of rainfall, in spite of the many disabilities which have been urged against it, is of more value than any other single element, in characterizing the season." Hooker is of the same opinion. He believes that "such portion of the effect of sunshine, humidity, the electrical state of the atmosphere, and probably even insect and fungoid attacks, etc., as has not been accounted for owing to their correlation with rainfall, is of minor importance."[4] On the other hand, Chilcott is convinced that in the Great Plains area of the United States it is not the most important determinant of yields.[5]

[1] Cf. Smith, *op. cit.*, 1920, p. 247.

[2] A. L. Quaintance and W. M. Scott, *The More Important Insect and Fungous Diseases of the Fruit and Foliage of the Apple* (U.S. Department of Agriculture Farmers' Bulletin 492), 1912.

[3] Fisher, *op. cit.*, 1921, p. 133.

[4] Hooker, *op. cit.*, 1921, p. 80.

[5] Chilcott, *op. cit.*

Even with less perfect methods and less reliable data than those of Fisher, useful results have been obtained. Moore has had much success in forecasting the yields of cotton.[1] Using methods analogous to those he had developed for cotton, he was able to forecast the yield for wheat, barley, and oats in the Dakotas more accurately than the United States Department of Agriculture in 8 cases out of 9. In the single case in which the Department of Agriculture was more accurate, its forecast was made within a fortnight of the harvest.[2] Hooker was able to get very good results for wheat in eastern England.[3] Wallén obtained satisfactory agreement with official estimates of yield for the different provinces of Sweden, even though his basic data left much to be desired.[4]

Besides the study of Moore, a number of studies on wheat have been made in the United States with, for the most part, fairly good results considering the general character of the data. Among the more interesting of these studies are those by Blair[5] and J. Warren Smith.[6] Not all of these are pushed to the point of attempting forecasts, but they bear directly on the question. In India very fair results have been attained by S. M. Jacob.[7] In Australia significant studies have been made by Barkley.[8] For Argentina, Hessling has demonstrated a negative correlation between temperature and wheat yields.[9] Rainfall he found not to be a matter of indifference, but correlations were much less definite than with temperature. Hessling was able to forecast the yields from the August to November temperature alone some time in advance of the harvest.

Moreover, by taking other weather factors into consideration in addition to temperature, the forecasts could no doubt be improved. The United States Department of Agriculture has been using the method of correlation in forecasting the yield in Argentina,[10] and also in India and Victoria.[11] The specific manner in which the method is being applied to the data for these countries has not yet been made public, only brief preliminary accounts of the work having appeared. The usefulness of drawing more than one weather factor into the computations is also made clear by the work of Kincer and Mattice.[12]

It is not easy to form a judgment concerning the practical usefulness of these forecasts at the present time because most investigators have compared their forecasts with official estimates of yields made after the harvest, sometimes several months later, instead of with forecasts made at corresponding dates before harvest as did Moore. Those who have compared forecasts based on weather with official crop estimates after harvest have not done justice to the method. It is true that in some years such forecasts diverge considerably from final yield estimates after harvest, but it is probable, as Moore found, that official forecasts not based on weather diverge still more from the final estimates.

A further difficulty in assaying the practical value of yield forecasts based on weather is the lack of a reliable standard of comparison. One can but assume that the official final estimates after the harvest are trustworthy. Yet errors in official estimates of wheat crops of 10 per cent are probably not unusual. The official estimate

[1] Moore, *op. cit.*, 1917.

[2] H. L. Moore, "Forecasting the Crops of the Dakotas," *Political Science Quarterly*, 1920, XXXV, 204 ff.

[3] R. H. Hooker, "The Weather and the Crops in Eastern England, 1885–1921," *Journal of the Royal Meteorological Society*, 1922, XLVIII, 115 ff.

[4] Wallén, *op. cit.*, 1917.

[5] T. A. Blair, "Partial Correlation Applied to Dakota Data on Weather and Wheat Yield," *Monthly Weather Review*, 1918, XLVI, 71 ff.; "Rainfall and Spring Wheat," *ibid.*, 1913, XLI, 1515 f.; "Temperature and Spring Wheat in the Dakotas," *ibid.*, 1915, XLIII, 24 ff.; "A Statistical Study of Weather Factors Affecting the Yield of Winter Wheat in Ohio," *ibid.*, 1919, XLVII, 841 ff.

[6] J. Warren Smith, "Effect of Snow on Winter Wheat in Ohio," *ibid.*, 1919, XLVII, 701 f.

[7] S. M. Jacob, "On the Correlation of Areas of Matured Crops and the Rainfall and Certain Allied Problems in Agriculture and Meteorology. (A preliminary enquiry)," *Memoirs of the Asiatic Society of Bengal*, 1907–10, XI, 347; "The Correlation of Rainfall and the Succeeding Crops with Special Reference to the Punjab," *Agricultural Journal of India, Indian Scientific Congress Number*, 1916, 86 ff.

[8] Barkley, *op. cit.*

[9] N. A. Hessling, "Relations between the Weather and the Yield of Wheat in the Argentine Republic," *Monthly Weather Review*, 1922, L, 302 ff.

[10] "The Agricultural Situation in Argentina," *Foreign Crops and Markets*, 1928, XVI, No. 16.

[11] "Relation between Wheat Yield and Rainfall in India and Australia," *ibid.*, 1927, XIV, No. 11.

[12] Kincer and Mattice, *op. cit.*

of the Argentine wheat crop of 1927–28 was certainly underestimated by about 10 per cent,[1] though whether due to an error in estimating yield or acreage it is not possible to say. It is probable that the differences between official estimates of yield and those based on the weather factors are in appreciable measure due to error in the official estimates. Similarly the Canadian crop has been apparently underestimated in each of the four crop years preceding the current year, twice by as much as about 10 per cent.[2]

Lines of Improvement

The directions in which the forecasting of crop yields from the weather may be improved are: improvement of the statistical methods; improvement of the meteorological data; improvement of the agricultural data.

To improve the statistical methods is a task for mathematicians. Great progress has been made in this direction, especially by Fisher, and while further improvements and refinements of methods will no doubt be forthcoming, it is probable that the methods now available are sufficiently good for the not very accurate data to which they must be applied. The greatest immediate need is for methods that will reduce the heavy labor at present required in making the computations. Another need is for better grouping of the data presented to the statistician. In a large country like the United States, climates and soils vary greatly. Political units are not necessarily climatically homogeneous. At present, data are grouped rather by political units, such as states, than by climatic or agronomic units. Most states are not homogeneous in regard to climate, soil, or types of agriculture. Many of them include several types of climate and of agriculture. A climatically and agriculturally homogeneous area may include portions of several states. When the data for such a state are lumped together, it is difficult and indeed frequently impossible for the statistical analyst to unravel relationships. These may differ in different parts of a state and so in the total for the state may be quite unrecognizable. It is, therefore, highly important that for forecasting purposes the country be redistricted, ignoring political units and dividing the country into a larger number of districts that are as far as possible homogeneous in climate and soil. Forecasts, if made for such districts and subsequently combined appropriately to represent political units, would be more accurate. To some extent, this plan is practiced in the United States Department of Agriculture, but it should be pushed much farther. Even with the meteorological data now being gathered, if taken from stations properly located and correlated with yield data from the same region, it is possible that statisticians would be able to furnish forecasts as good as or better than are made at present.

The meteorological data on the whole are as accurate as can be expected. Their principal defect is that in many regions the series do not extend as yet over a sufficiently long number of years. That is a defect that will remedy itself in time. Another defect is that the data are often too much limited in scope, being usually confined to daily rainfall and maxima and minima of temperature. More complete records for more stations are needed. It will probably also prove profitable to add to or to substitute for the meteorological observations records of soil conditions. It is not unlikely that the moisture content of the soil at different depths may prove to be a better index of probable yield than rainfall. Similarly, records of soil temperature at different depths may prove a better index during the germination period than air temperatures. At the very least, studies should be made to compare the value for forecasting purposes of these data with the meteorological data commonly used. The reading of soil thermometers is not difficult. With recording thermometers, even reading is unnecessary; the records may be sent in to the central station from time to time. The taking of a soil sample is not difficult; it may be shipped in a sealed container to a central station for the moisture determination.

By and large, it is the agricultural data that are the least perfect and most readily

[1] Cf. a forthcoming Wheat Study, viz., "Review of the Crop year, 1927–28," Wheat Studies, 1928, V, No. 2.

[2] *Idem.*

capable of improvement. In the main, statisticians and meteorologists are waiting for progress by agricultural scientists. This can hardly be made until much further research has been carried on concerning the reaction of crops to various weather factors. The quickest and most effective way to get much of this information is through carefully controlled laboratory experiments. It is important, if this work is to be done with reasonable despatch, that it be assisted and supported by governments, for, if special inducements are not offered, plant physiologists in sufficient numbers will not attack the problems. There are so many problems of greater biological interest, though not of greater economic importance, that may be undertaken with modest resources and solved with less labor that these will continue to engross the attention of physiologists, unless some sort of subsidy is offered.

At the same time, a series of field experiments should be undertaken of the type described in a previous section. The stations should be scattered widely at points strategically located as regards climate and soil. The stations need not be elaborate or expensive to operate. While the results to be anticipated cannot be obtained until after a long period of years, the stations may well serve as samples for the regions in which they are located. It is not impossible that a thousand or even fewer stations appropriately located in the United States might give data permitting far more accurate crop forecasts than many thousands of condition reports from crop correspondents. The operating costs might not be very much greater after the expenses of installation have been met than for the methods now in use. Moreover, at the same time, the stations would furnish priceless phenological and other data. The United States Department of Agriculture and the experiment stations of the several states already maintain a goodly number of stations that with certain simple adjustments would serve the purpose for their respective regions.

In the meanwhile, it would be well worth while to try the experiment of asking a carefully chosen, small list of crop correspondents to send soil for moisture determinations to a central laboratory. It would not be necessary to collect samples throughout the growing season of wheat. A few samples from each locality collected at the critical stages—say the time of sowing, the time of emergence, the beginning of flowering, and the end of flowering—should be sufficient. It is highly probable that a statistician with a good series of soil-moisture data before him would forecast yields more accurately and at less expense than by current methods.

In short, the conclusion is warranted that the time is ripe to use the weather to a greater extent than has been the practice in the past as a basis of forecasting the wheat crop. If the lines of investigation that have been suggested by numerous competent scientists are prosecuted vigorously, it is well within the range of possibilities that within a few decades this type of forecasting may supersede, or at the very least, supplement in important ways, present subjective methods. Moreover — and this is a very important consideration in any question which has political aspects, as nearly every economic question has—the forecasts would be more objective than those made by present methods. They could be checked by any one who cares to take the trouble; the government's forecast would be more defensible against the charge, very frequently made, that there is bias, deliberate or unconscious, in its published figures. Governments will undoubtedly proceed cautiously, and, while the statistical methods are being tested, will use them for many years merely as checks upon present methods.

The forecasting of crop yields must, in all probability, always depend in part upon statistical analysis. Experimental work will, as far as one can at present foresee, make its greatest contributions toward the problems of forecasting by furnishing improved bases for statistical analysis. It is capable of determining critical periods that may be recognized through statistical analysis alone with difficulty, and, above all, it is capable of determining rather precisely those factors that exert the greatest influence upon crops. It can discover, as statistical analysis by itself never can, how and why certain environmental influences affect

crop yields; it is clear that such knowledge is of the greatest importance in statistical analysis, which is never a mere mechanical, mathematical process like the operation of a calculating machine. Statistical analysis demands the exercise of judgment, and the broader the basis of knowledge upon which such judgment is based, the better and more rational the results.

Experiments may serve in other ways also to facilitate and render more precise the work of the statistician. They should be of great value in making clear the form of the relationships between environmental factors and yields, whether the relationship is linear or not, and, if curvilinear, experiments may well give indications regarding the type of curve that would best express the relationship. When the experiments are conducted under conditions closely approximating those in the field, as regards soil character, fertilizer applied, method of cultivation, weed infestation, and susceptibility to disease, they may form the basis for a complete formulation of the forecasting equation, subject only to adjustment from the statistics to assure the mean of the forecasts remaining close to the mean of the actual yields.

Even when the experiments have been conducted under conditions believed to be considerably different from those in the field, the indicated effects of the minor weather factors may frequently be more trustworthy than the effects of such factors as measured statistically. It will undoubtedly prove desirable on occasion to build up forecasting equations by combining coefficients for the major factors derived statistically with coefficients for minor factors derived experimentally.

Special study will also have to be made of trends of yield through collection of data on factors affecting the trends. The effects of such factors as the introduction of new varieties, better seed or certified seed, new methods of culture, changes in fertilizer practice, soil exhaustion, geographic shifts in the areas under cultivation, will always require close watching since they may cause a change in trend of yields. Unfortunately, such changes in trend will affect the computed line of trend only after they have been in force for a period of years. It is well known that a line of trend may become subject to an increasing error at its extremes. Unless the forecaster is on the lookout for new factors possibly affecting trends of yields and is ready to make allowances for them, he may be seriously misled. The forecaster must also take into consideration in each year special conditions that may arise to change the critical stages of the plants' growth from the normal, as, for example, dates of sowing.

In short, the forecasting of yields from the weather cannot safely be left wholly in the hands of the agricultural meteorologist, or of the statistician, or of the agronomist. The successful solution requires the co-operation of all these, together with that of the physiologist. Such co-operation will have to be maintained for many years to come in order that the forecasting may not leave out of consideration new factors resulting from changes in agricultural practice or fail to apply new discoveries in the several sciences. For some time to come, the best results may be obtained by basing estimates of the effect of minor factors on experimental results, estimates of the effect of major factors on statistical results.

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This issue is the work of Carl L. Alsberg, with the assistance of E. P. Griffing.

JAN 15

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 2 DECEMBER 1928

THE WORLD WHEAT SITUATION, 1927-28

A REVIEW OF THE CROP YEAR

THE wheat year under review, like the year preceding, was a fairly normal one, taking account of upward trends in production, trade, and utilization. World acreage set a new record. Yield per acre, though not extraordinarily high, was above the post-war average. Excluding Russia, the 1927–28 crop approximated the big crops of 1915 and 1923. Russia included, the world outturn was a little above that of 1926, and was exceeded only by the bumper crop of 1915. Distinctly large crops were harvested in Canada, South America, and a few European countries, and distinctly small ones only in Australia, Jugo-Slavia, and the soft red winter-wheat belt of the United States; but in general the crop distribution was not extreme. Wet harvests, in Canada and part of Europe, lowered grades and damaged quality.

International trade was heavy, though not quite as large as in 1926–27 or in 1923–24. The great exporters—Canada, the United States, and Argentina—furnished an unusually large proportion of total exports. The international position was neither tight nor easy. Prices in general continued the decline from the high level of 1924–25, but were about midway between that peak and the trough of 1923–24. Commercial visibles ran high, and were exceptionally heavy at the close of the year, especially in Canada; but the total outward carryover probably did not exceed the large carryin.

Bad prospects for the 1928 crop, especially in the United States and to some extent in Europe, caused sharp advances in prices from February to April 1928. After May 1, however, a general and marked improvement in new-crop prospects, coupled with the weight of visible supplies, caused a spectacular price decline which continued beyond the end of the crop year.

STANFORD UNIVERSITY, CALIFORNIA

December 1928

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

The central feature of the series is a periodic analysis of the world wheat situation, with special reference to the outlook for supplies, requirements, trade, and prices. Each volume includes a comprehensive review of the preceding crop year, and three surveys of current developments at intervals of about four months. These issues contain a careful selection of relevant statistical material, presented in detail in appendix tables for reference purposes, and in summary form in text tables and charts.

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Volumes I–IV are now available, bound in red buckram, at $10.00 each. The ten issues of Volume V will be published monthly from November 1928 to September 1929, except in April 1929. The subscription price for the volume, including a temporary binder, is $10.00. Individual issues may also be purchased separately. Orders, subscriptions, and other communications should be addressed to Food Research Institute, Stanford University, California, or, for Great Britain, to P. S. King & Son, Ltd., Orchard House, 14, Great Smith Street, Westminster, S.W. 1, London.

Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.
Published by Stanford University for the Food Research Institute.

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FOOD RESEARCH INSTITUTE

STANFORD UNIVERSITY, CALIFORNIA

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The Food Research Institute was established at Stanford University in 1921 jointly by the Carnegie Corporation of New York and the Trustees of Leland Stanford Junior University, for research in the production, distribution, and consumption of food.

THE WORLD WHEAT SITUATION, 1927-28

A REVIEW OF THE CROP YEAR

This review is designed to present a balanced, comprehensive statement, in due perspective, of a year's developments in the world wheat situation, in the light of fuller information than is available in the course of the year. The series of annual reviews, of which this is the fifth, not merely furnishes a continuing historical record, but makes for an increasingly reliable understanding of the permanent factors in the wheat market and contributes an essential background and basis for analyses, judgments, and forecasts regarding current and future developments.

SUMMARY

Crop scares in the late winter of 1928, later to prove unjustified, constituted the major disturbing factor in what can otherwise be called a fairly normal wheat year. Apart from this, however, 1927–28 displayed a group of distinctive characteristics.

World wheat acreage, in continuation of its upward trend since the war, appears to have set a new record. The average world yield per acre, Russia excluded, was somewhat above the post-war average, but much lower than in the exceptionally good years 1915 and 1923. The world crop of 1927 was one of the three largest ever harvested. The crop, exclusive of Russia, was about as large as those of 1915 and 1923; inclusive of Russia, it approximated those of 1915 and 1926. But wheat disappearance both for food and seed, and perhaps for feed as well, has been tending definitely upward in recent years. Even per capita consumption for food appears to be tending upward except in English-speaking countries and France. Trends in absorption considered, therefore, the 1927 crop was not oppressively large.

Nor was the distribution an extreme one. There were few instances of record crops or exceedingly poor ones. Large outturns in Canada and Argentina and a good crop in the United States coincided with fair crops in Europe and Russia, a mediocre one in India, and a short crop in Australia. Hence three countries of North and South America, which usually furnish the great bulk of the export wheat, contributed an even larger proportion than usual.

The international statistical position was neither tight nor easy. Exportable surpluses were substantial, but so also were import requirements. Europe's import demand was the larger because a wet harvest damaged considerable quantities of wheat and rye in countries north of the Alps, and because crops of feed grains were rather scanty, growth of livestock population considered.

The international movement of wheat was one of the heaviest in history. Net exports were around 820 million bushels, a little smaller than in 1923–24, and some 30 million bushels less than in 1926–27. Ex-European importing countries as a whole took more wheat than in 1926–27, while European importers took less. Europe's imports, however, decreased by less than the increase in domestic crops. This was attributable to lower wheat prices, larger quantities of unmillable wheat, higher prices of feed grains, and the upward trend of human consumption. Most countries of northern and central Europe imported more wheat than ever before. Because of short crops, Australia, Roumania, Jugo-Slavia, and India exported little wheat. Russia, whose good crop was situated unfavorably for export, furnished small exports and imported perhaps an equal amount toward the end of the year. But Canada, the United States, and Argentina were abundantly able to ship the quan-

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tities demanded abroad. Three noteworthy features of the international movement were the record aggregate shipments from the ports of the Pacific Northwest; the restricted exports from the United States in the second half of the crop year; and exceptionally large exports from Canada in the months of June and July.

Commercial visibles chiefly in the United States and Canada ran exceptionally high throughout the second half of the year; and total year-end stocks in the major exporting countries and afloat were somewhat the highest of any post-war year. Canadian stocks attained notably high levels, mainly because of a number of unpredictable caprices of the weather. European stocks, both of import and domestic wheat, however, on the whole appear to have declined in the course of the year. Hence the net change in world stocks was presumably slight, and the outward carryover, like the inward one, stood fairly high.

Export prices, and world prices by and large, were somewhat lower than in 1926–27, and roughly midway between the low post-war level of 1923–24 and the high level of 1924–25. Prices on the international import markets ruled lower than in 1926–27, partly because of a somewhat easier statistical position, but also because in part of 1926–27 these prices were abnormally enhanced in a period of high ocean freight rates peculiar to that year. Poor quality was a special factor contributing to depress prices in several European countries.

The outstanding features of the price movement were a rapid advance in February–April 1928, followed by a marked recession in the next three months. The rise was due to unfavorable new-crop prospects for winter wheat, especially in the United States but also in Europe, and had little relation to the supply position of 1927–28. The spectacular decline was due to marked improvement in the new-crop outlook, coupled with the pressure of exceptionally heavy visible supplies in export countries following a period of restrained sale. Both rise and fall were sharpest in the United States, where the reversal in crop prospects was most pronounced.

I. THE SUPPLY POSITION

Initial Carryovers

World stocks of wheat and flour significant in commerce were relatively large at the beginning of the crop year 1927–28, apparently larger than at the opening of any of the past six crop years except 1924–25.[1] In that year short crops and high prices led to heavy reductions in stocks. The level remained abnormally low in 1925–26. But in 1926–27, in consequence of abundant crops in exporting countries and moderately low prices, a substantial upbuilding of stocks took place in many countries. To large initial carryovers in 1927–28 were added the excellent crops of 1927.

North American Wheat Crops of 1927

According to official estimates now standing, the combined crop of the United States and Canada reached 1,318 million bushels in 1927. It exceeded the crop of 1926 by about 80 million bushels, and was clearly the largest outturn in history except for the bumper crop of 1915. The United States crop of 878 million bushels, though above average, was not of distinctly exceptional size; it had been approximately equaled[2] in three of the past eighteen years and exceeded in four. The Canadian crop, however, was the largest in history except for the 474 million bushel crop of 1923; and it was probably as large as that crop, since the official estimate of 440 million bushels seems below the truth.[3]

[1] See Table 7, p. 61.

[2] The crop of 1926, officially placed at 831 million bushels, appears to have been underestimated; and we reckon it about as large as the crop of 1927. The crop of 1927 is thought by many to have been overestimated; but in our judgment the fact is not clear. Disposition statistics (see Appendix Table XXXI) show a residual item covering feed, waste, and error in estimate of 81 million bushels, a figure in line with those of 1922–23, 1923–24, and 1924–25. Low figures for 1925–26 and 1926–27 indicate clearly that official estimates were too low in these two years; but whether or not the crops of 1922–24 and 1927 were overestimated remains uncertain. One can say with assurance only that the crop of 1927 certainly was not underestimated, and may have been slightly overestimated.

[3] See below, p. 56.

The winter-wheat crop of the United States proved a disappointment, after promising well throughout the winter and early spring. The area sown was considerably larger than in the preceding three years, though smaller than in the first five years after the war; and abandonment, while larger than in 1926, was not far above average.[1] Official estimates of condition as of April 1 and May 1 were somewhat higher than in any of the preceding five years; and early in May private and official forecasts of production[2] suggested a crop of around 600 million bushels, a fairly high figure in view of the acreage remaining for harvest. But expectations were reduced during May, especially with respect to the crop in the southwestern states and in the Ohio Valley; and condition on June 1 was officially placed at 72.2 per cent, the second lowest figure in seven years. There was some recovery in June, but threshing returns were disappointing. The latest official estimate indicated a per acre yield of 14.7 bushels and a crop of 553 million bushels—well above the distinctly poor crop of 1925 but otherwise somewhat the smallest crop of recent years. With the crop of 1926, some 627 million bushels, the 1927 crop compared the more unfavorably because the former was apparently underestimated.

By contrast, the United States spring-wheat crop of 1927 turned out remarkably well after a poor start. Seeding was delayed by excessive rainfall during April and early May. Nevertheless an area of 21.06 million acres was harvested, the largest ever recorded except in the three war years 1918, 1919, and 1920. Aside from rust infestation in the southeastern portion of the spring-wheat belt during July, the crop progressed favorably. Private forecasts of production as of June 1 averaged 233 million bushels; but the first official forecast as of July 1 was 274 million, and subsequent official forecasts and estimates were higher still.[3] By December 1 the official estimate stood at 319 million bushels, and the final estimate of 326 million gave a figure equaled or exceeded only three times since 1910. The crop was of record size for post-war years; it surpassed the very short crop of 1926 by over 120 million bushels or 60 per cent. The yield per acre of 15.5 bushels was notably high; in only four years since 1910 have higher figures been recorded.

Thus the large outturn of spring wheat offset the rather low outturn of winter wheat. The total 1927 crop of the United States finally ranked as a good one, approximately equal to those of 1922, 1924, and 1926, and clearly inferior only to those of 1914, 1915, 1918, and 1919.

In view of the many factors affecting quality — test weight, moisture content, dockage, protein content, and others—the general quality of the United States crop is always difficult to assess with precision. The evidence suggests, however, that the winter- and spring-wheat crops were both about average. Some 73 per cent of the winter-wheat crop graded Nos. 1 and 2, a figure considerably lower than that of 1926, when the crop was of unusually good quality, but about the same as in 1924 and 1925 and higher than in 1921–23.[4] About 71 per cent of the spring-wheat crop graded Nos. 1 and 2, a figure higher than those of 1921, 1923, 1925, and 1926, but lower than those of 1922 and 1924. On the basis of grading alone, the total crop appears to have been rather above average in quality than below. But the prevalence of exceptionally high premiums for protein content on hard red spring and hard red winter wheat suggests relatively poor quality with respect to this important factor. According to adjusted census data, the amount of wheat required to produce a barrel of flour was 4.689 bushels in 1927–28; the figure suggests better than average quality, since it was somewhat the lowest in the past eight years except for 1924–25 and 1926–27.[5]

In distribution by classes,[6] the crop of 1927 was noteworthy for the small outturn of soft red winter wheat, the large proportions of hard red spring and durum, and

[1] See Appendix Table VI.

[2] See Appendix Table VII.

[3] Private forecasts differed from the official in showing a decrease between August 1 and September 1; and October private estimates averaged some 20 million bushels below the official. Some students regard the official estimate now standing as too high; but conclusive evidence is not available.

[4] See Appendix Table VIII.

[5] For comparable figures, see below, p. 56.

[6] See Appendix Table IX.

the good crop of Pacific white. Among the states leading in the production of hard red winter wheat, Oklahoma harvested a notably poor crop, Nebraska the largest crop in her history. All of the leading producers of soft red winter wheat, Michigan excepted, secured poor crops; Illinois and Missouri suffered most. Of the four leading producers of hard red spring and durum, all but Minnesota had crops well above average in size; and Montana secured the largest outturn in her history, 80 million bushels. Idaho, Washington, Oregon, and California together harvested a crop of 131 million bushels, the largest in history except for that of 1923, though none of the four obtained a crop which had not been exceeded in several other years.

The Canadian crop of 1927 came through a series of vicissitudes with distinct success. Like the United States spring-wheat crop, it was sown late. The late sowing gave rise to more than the usual risk of damage from rust and frost during the growing season, but it did not greatly reduce acreage. The final official estimate of wheat area was 22.46 million acres, the highest figure on record except for those of 1921 and 1926.[1] Rainfall during June and July was ample; but rust infestation in its incipient stages was reported from Manitoba and parts of Saskatchewan during July and early August, and gave rise to much uneasiness in world markets. Progress of rust was retarded by cool weather. Accentuating the precarious condition, a serious frost occurred in some regions on August 7. Nevertheless, as early as August 1 private observers anticipated a distinctly large crop —400 million bushels or more; and the official forecast as of July 31, 357 million bushels, was generally regarded as too low. In spite of the frosts of August, the next official forecast of 459 million bushels was in line with unofficial estimates as of August 31. Harvest began late as a result of late sowing, and rain and snow hindered harvesting and threshing operations, delayed the flow of wheat to market, and gave rise to some reduction in later official estimates of production.[2] The final estimate was 440 million bushels. Many observers, however, regard this estimate as too low,[3] and our own calculations, which agree closely with others, suggest that it should be raised by some 40 million bushels.[4] Hence the Canadian crop of 1927 may in fact have equaled or even slightly exceeded the 474 million bushel crop of 1923. Yield per acre of 19.5 bushels was the highest since 1915, except for that of 1923.[5]

The crop was distinctly poor in quality. Weight per measured bushel was officially estimated as 58.75 pounds, the lowest since 1917 except for the crop of 1921. Grain unmerchantable and lost in cleaning was placed at 39 million bushels, the highest figure in the past eight years.[6] Protein content was the lowest in six years, according to data of the Canadian Pool; No. 3 Manitoba averaged only 11.80 per cent in protein content as against 12.40 per cent in 1926–27 and a six-year average of 13.08 per cent. The grading of the crop, as shown in Table 1, was the poorest of the past five years. Less than 1 per cent of the wheat inspected in the Western Division graded No. 1 Northern; only 7.7 per cent graded No. 2 Northern. The percentage grading No. 3 was relatively high, as was the proportion of Nos. 4, 5, and 6. As in 1926–27, a large proportion was classified as "No grade" on account of excessive moisture content; but this wheat apparently proved satisfactory for milling when properly dried. All told, the crop of 1927 contained far more than the usual proportion of frosted, rusted, and damp kernels, especially the last. Nevertheless the quantity of sound milling wheat obtainable under appropriate methods of cleaning and conditioning was distinctly large because the crop was large; the crop was of poor qual-

[1] See Appendix Table I.

[2] See Appendix Table XI.

[3] See especially *Foreign News on Wheat*, August 20, 1928, p. 18.

[4] See Appendix Table XXXI.

[5] Statistics of Canadian production, acreage, and yield per acre must be employed with caution. Fairly conclusive tests of the accuracy of production estimates may be secured for recent years, as shown in Appendix Table XXXI. But when production estimates are apparently erroneous, errors must have been made either in the acreage or in yield per acre estimates. In a country containing so large a pioneer area, the acreage would presumably tend to be underestimated rather than overestimated; but probably not by a constant percentage each year.

[6] See Appendix Table XXXI.

ity as compared with most other Canadian crops, but even so Canada produced a huge crop of millable wheat.

TABLE 1.—PERCENTAGES OF VARIOUS GRADES OF CANADIAN HARD RED SPRING WHEAT TO TOTAL WHEAT INSPECTED IN THE WESTERN DIVISION, SEPTEMBER–AUGUST 1923–28*

Classification	1923–24	1924–25	1925–26	1926–27	1927–28
No. 1 Northern ...	37.3	19.3	22.4	9.2	.9
No. 2 Northern ...	25.8	18.3	27.1	17.5	7.7
No. 3 Northern ...	22.9	18.6	13.9	7.8	22.3
Nos. 4, 5, 6	9.2	27.6	4.2	5.5	20.2
Feed, etc.[a]	3.1	1.8	1.3	2.6	1.5
No grade[b]	1.0	12.2	28.6	51.2	43.1
Total above	99.3	97.8	97.5	93.8	95.7

* Data from *Canadian Grain Statistics.*

[a] Includes also rejected, condemned, and no established grade.

[b] Wheat containing a higher proportion of moisture than wheat of numbered grades. Aside from higher moisture content, it may be of as good quality as the numbered grades, and is always better than feed, rejected, or condemned wheat.

EUROPEAN CROPS

The wheat crop of 1927 in Europe (ex-Russia) was relatively large—some 1,263 million bushels, according to the latest available official data,[1] as shown in Table 2. It ranked with the good crops of 1921, 1923, and 1926 rather than with the excellent one of 1925 or the poor ones of 1920, 1922, and 1924. Of the eleven European countries which ordinarily produce more than 30 million bushels of wheat, Hungary, Bulgaria, Germany, and Czecho-Slovakia secured the largest outturns of post-war years; the British Isles, France, Spain, Poland, and Roumania harvested crops slightly above the average of the preceding five years; and Italy and Jugo-Slavia obtained crops below average in size.[2] South and east of the Alps harvest operations appear on the whole to have been conducted under favorable conditions, and quality was good. But in France, Great Britain, Germany, Poland, and other countries lying mostly west and north of the Alps, heavy rains delayed the harvest and resulted in an unusual proportion of bleached, damp, and sprouted grain unfit for milling. Hence, with deductions for this unmillable grain, the total European crop compared somewhat the less favorably with the crops of preceding years. The precise quantity of unmillable wheat cannot, of course, be measured.

TABLE 2.—EUROPEAN (EX-RUSSIAN) GRAIN AND POTATO CROPS, 1920–27*

(*Million bushels*)

Year	Wheat	Rye	Potatoes	Corn	Barley	Oats
1920	946	533	3,351	520	551	1,478
1921	1,215	758	3,078	393	566	1,509
1922	1,038	713	4,803	423	598	1,544
1923	1,249	823	3,864	467	663	1,756
1924	1,050	651	4,201	590	577	1,628
1925	1,390	937	4,745	626	691	1,792
1926	1,203	745	3,840	665	689	1,922
1927	1,263	800	4,735	482	680	1,840
Average 1909–13 .	1,347	977	4,162	528	701	1,931
1922–26 .	1,186	774	4,290	554	644	1,728

* Summarized from most recent official data for individual countries, as reported by the U.S. Department of Agriculture. Excludes a few minor European producers. Pre-war averages are estimates for territory within present boundaries, and include 2-year or 4-year averages for a few countries.

The rye crop[3] of around 800 million bushels was also fairly large, being exceeded in post-war years only by the good crop of 1923 and the bumper crop of 1925. In effect the crop of 1927 was probably not so large as the bare figures suggest. It too suffered in quality from the unfavorable harvesting weather. And since Europe's production is largely concentrated in central and northern Europe, the proportion of unmillable grain was probably heavier in the rye than in the wheat crop. European crops of potatoes, barley, and oats were also among the largest of post-war years; but the corn crop of 1927 was relatively small.[4] With respect to the bread grains and potatoes, therefore, European native supplies appear to have been larger in 1927–28 than in any other post-war year except 1925–26; but supplies of feed grains were not as large as in 1926–27, and but little larger than in 1923–24. The feed grain supply situation of 1927–28 was relatively tight, not because of poor crops but because the European livestock count has

[1] Revisions of official estimates in the course of the year were insignificant and in general compensating.

[2] See Appendix Table III.

[3] See Appendix Table IV.

[4] See Appendix Table V.

been increasing and was unusually high in 1927.[1]

Russia also secured good crops in 1927. According to the latest official estimates, the wheat crop reached 749 million bushels, about the same as in 1925, some 70 million bushels smaller than in 1926, but otherwise much the largest of post-war years. Acreage was exceptionally large, but the yield per acre was low. The rye crop reached 933 million bushels, the largest of post-war years and 30 million above the crop of 1926. The potato crop was excellent. Russia apparently had available in 1927–28 some 40 million bushels less of the two bread grains than in 1926–27, though she had nearly 190 million bushels more of potatoes.

Other Northern Hemisphere Crops

In spite of a harvested acreage below the average of the preceding five years, and far below the high figures of 1926, the three French dependencies of northern Africa secured wheat crops totaling 61.2 million bushels, smaller only than the crops of 1923 and 1925. Egypt obtained the largest crop of post-war years from the largest acreage. For the third successive year India harvested a mediocre crop, some 335 million bushels. In the three years 1925–27, the Indian crops averaged 330 million bushels, while the good crops of the three preceding years averaged 367 million. Low yield per acre rather than low harvested acreage was responsible. The Japanese crop of 40.4 million bushels was slightly the largest since 1920. The Chinese and Manchurian crops, for which estimates are not available, are reported to have been of distinctly good size, certainly larger than those of 1925 and 1923.

Southern Hemisphere Wheat Crops

The wheat acreage of 1927 in both Argentina and Australia, in continuation of an upward trend, was the largest on record, despite drought in both countries during the seeding season. According to the official estimate, the Argentine crop of 239 million bushels was the largest in history except for that of 1923. Moreover, the standing estimate seems appreciably too low;[2] and the crop in reality may have exceeded that of 1923. It appears to have been well above average in quality. Chile and Uruguay also secured record crops. The Australian crop, however, was distinctly small, only 110 million bushels as compared with 161 million in 1926 and an average of 135 million in 1922–26. Yield per acre of 9.3 bushels was the lowest in recent years on account of deficient rainfall not only during the crucial months of August and September, but also in the seeding season. Quality, as usual, was good. New Zealand had a distinctly large crop, South Africa a small one. All told, the wheat crop in the Southern Hemisphere approximated 417 million bushels, without allowance for an underestimated crop in Argentina, a figure exceeded only in 1923 and 1926. Unlike the Canadian, the Southern Hemisphere crops progressed uneventfully after seeding was accomplished, and gave rise to few disturbances in prices in world markets.

World Wheat Crops Summarized

Charts 1, 2, and 3 summarize data on world wheat production, acreage, and yield per acre in 1927, with comparisons for earlier years. As Chart 1 shows, the world crop ex-Russia and China, according to the estimates of the United States Department of Agriculture, in 1927 reached approximately 3,543 million bushels. This outturn was exceeded only slightly by the crop of 1923, and was somewhat larger even than the crop of 1915. If probable underestimates of the Canadian and Argentine crops be considered, the world crop of 1927 was apparently the largest ever harvested. It exceeded the crop of 1926 by about 120 million bushels, more or less; precise comparisons are misleading in view of inaccuracies in crop estimates.[3] Including Russia, and again employing the Department's figures, the crop of 1927 reached about 4,290 mil-

[1] See *Agriculture Yearbook, 1927*, pp. 982, 1003 f.

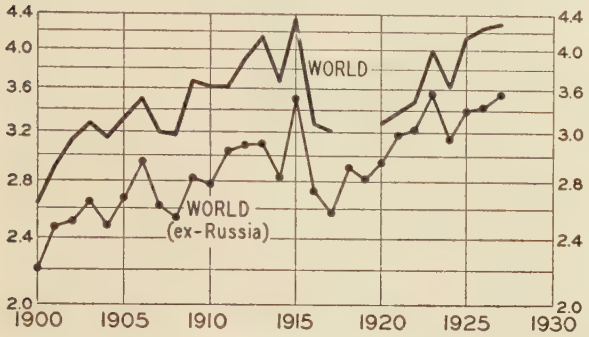
[2] See below, p. 57, and Appendix Table XXXI.

[3] Thus the French, American, and Canadian crops of 1926 appear to have been underestimated; the Canadian and Argentine crops of 1927 undesestimated; the American of 1927 (possibly) overestimated. But these errors cannot be measured precisely. Moreover, there is good reason to suppose that the

lion bushels, a higher outturn than in any other year except 1915, but only 60 million above the crop of 1926. Production either of the world or of the world ex-Russia appears to have fallen close to the line of post-war trend (measured from 1921 or 1922), but rather above than below. Broadly speaking, the year 1927 is to be regarded as a normal and not an exceptional year in wheat production.

CHART 1.—WORLD WHEAT PRODUCTION, 1900–1927*

(Billion bushels; logarithmic vertical scale)



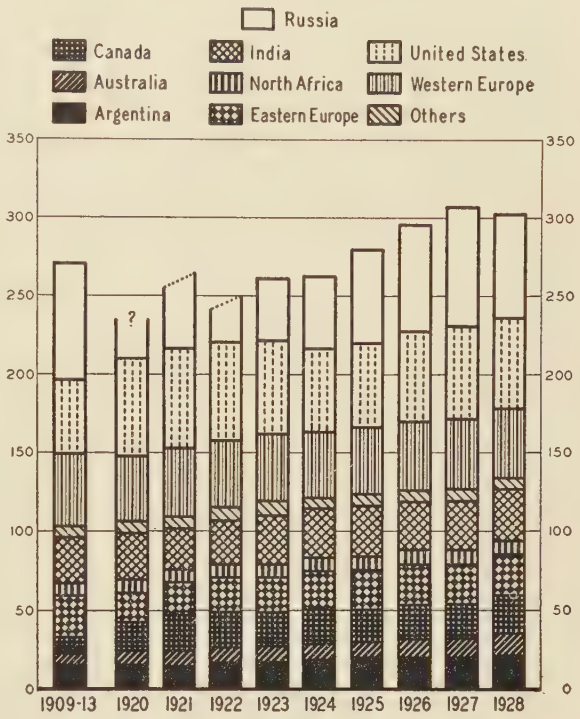
* Chiefly official data, supplemented by estimates of U.S. Department of Agriculture, from *Agriculture Yearbook 1927*, p. 748, and *Foreign Crops and Markets*. Russian production figures for 1923 and 1924 from *International Yearbook of Agricultural Statistics, 1926–27;* Russian figures for 1920–22 are incomplete.

Chart 2 shows trends in wheat acreage over the past nine years in comparison with the pre-war average. Expansion of acreage has proceeded without a break since 1920 in almost all regions except the United States and Russia, though most of the expansion is accounted for by Argentina, Australia, Canada,[1] and the countries of eastern Europe. Wheat acreage, including or excluding Russia, reached its highest point in 1927, and hence was partially responsible for the large world crop.

Chart 3 (p. 52) helps to explain the upward trend of wheat production since 1921 and the large crop of 1927. This chart shows yields per acre in the world ex-Russia and in different regions, in terms of percentage deviations from eight-year average yields, 1920–27. There was obviously an upward trend in yield per acre over this

CHART 2.—WORLD WHEAT ACREAGE, BY PRINCIPAL PRODUCING AREAS, AVERAGE 1909–13 AND ANNUALLY 1920–28*

(Million acres)



* Data from U.S. Department of Agriculture, *Agriculture Yearbooks* and *Foreign Crops and Markets*, and from *International Yearbooks of Agricultural Statistics*. Partly acreages sown, partly acreages harvested. For Russia, data not available in 1920; acreages in 1921 and 1922 estimated to lie within ranges indicated; acreage in 1924 shown 6.7 million acres below the latest revision, which was not available when chart was drawn.

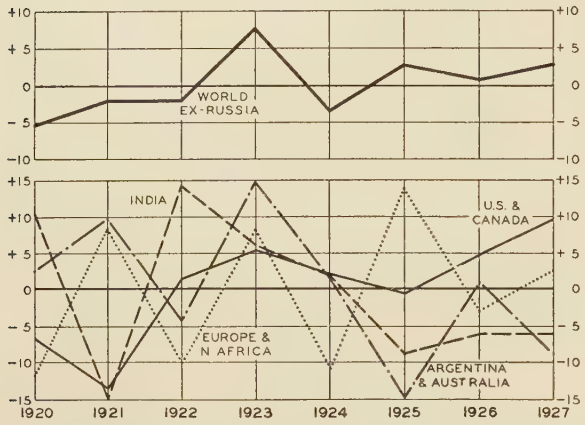
period; and such a trend is not unreasonable in view of the recovery of agriculture in Europe and improved methods of wheat production in other countries. But even a single year of yields as far below average as those of 1923 were above average would suffice to alter the direction of the trend substantially. Moreover, the period is too short, and fluctuations in yields are too large, to justify the statement that the post-war trend in world yield per acre is definitely upward on account of improved cultural practices. The chart is here presented to emphasize the broad facts that world yield per acre in 1927, though above aver-

American and Canadian crops of 1925 were underestimated; and reputable students believe that pre-war Russian crops were underestimated, and that German pre-war crops were overestimated while early post-war crops were underestimated. Further study might throw suspicion upon other estimates.

[1] The upward trend was not unbroken in Canada; but here the interruptions have been due chiefly not to intentional reduction of areas, but to unfavorable weather curtailing the area seeded.

age, was not extraordinarily high, as in 1923; and that only in Canada and the United States was yield per acre distinctly exceptional, some 9.5 per cent above average. In 1923, yield was high in all regions. The large world crop of 1927 was due to exceptional acreage and moderately high yield, whereas the large crop of 1923 was due to generally high yields per acre in a degree considerably more marked.

Chart 3.—Wheat Yields per Acre in Principal Producing Areas, in Terms of Percentage Deviations from the Average, 1920–27*



* Computed from data of U.S. Department of Agriculture. See Appendix Table II.

Table 3 summarizes the distribution of world wheat crops. The outstanding feature of the distribution in 1927 was the relatively large proportion of the world crop produced in North and South America. The United States, Canada, and Argentina secured crops well above average in size; but the Australian and Indian were distinctly below average, and the European and northern African only a little above. The distribution differed from that of 1926 chiefly in that Russia and Australia had smaller crops, while the United States, Canada, Argentina, and the importing countries of Europe had distinctly larger ones. A striking similarity appears between the distribution of crops in 1927 and 1923, the only outstanding differences being the smaller crops of the United States and Russia, and the larger crop of India, in the earlier year. Like 1923 and 1926, the year 1927 was characterized by a much more normal distribution than those of 1924 and 1925. In 1924 the Canadian and European crops were abnormally small, the Australian abnormally large; in 1925 European crops were abnormally large, the American unusually small.

Table 3.—Wheat Production in Principal Producing Areas, Pre-War and Post-War*

(*Million bushels*)

Year	United States	Canada	Soviet Russia	Lower Danube[a]	Other Europe	North Africa	India	Japan, Chosen	Northern Hemisphere ex-Russia	Argentina	Australia	Southern Hemisphere	World ex-Russia
1920.....	833	263	...	172	774	71	378	41	2,550	156	146	350	2,900
1921.....	815	301	...	212	1,002	98	250	40	2,726	191	129	376	3,102
1922.....	868	400	...	224	815	71	367	39	2,800	196	109	354	3,154
1923.....	797	474	419	260	989	106	372	35	3,051	248	125	427	3,478
1924.....	864	262	472	204	846	85	361	35	2,671	191	165	407	3,077
1925.....	676	395	730	296	1,094	105	331	40	2,949	191	115	360[b]	3,309[b]
1926.....	831	407	820	294	909	90	325	39	2,906	221	161	435[b]	3,341[b]
1927.....	878	440	749	278	986	106	335	40	3,076	239	110	417[b]	3,493[b]
1928.....	903	501	860	364	1,003	106	290	42	3,221	...	150	...	.....
Average													
1909–13...	690	197	759[c]	330	1,017	93	352	32	2,725	147	90	280	3,005
1922–26...	807	388	610[d]	256	930	92	351	38	2,875	209	135	397	3,272

* Summarized from most recent official data for individual countries (see Appendix Table III), as reported by the U.S. Department of Agriculture. Totals exclude China, Asia Minor, Brazil, and a number of small producers. All estimates are for territory within post-war boundaries.

[a] Hungary, Bulgaria, Roumania, Jugo-Slavia.

[b] Includes our estimate for Peru.

[c] Regarded as too low by Soviet officials, whose estimate is 908 million bushels.

[d] Four-year average.

The International Statistical Position

The influences affecting international wheat prices are many. Among these, however, none seems more important (at least

in the absence of monetary disturbances which violently affect the general level of prices) than the relationship between exportable surpluses of wheat in exporting countries and the quantities of wheat required for import by importing countries. This relationship depends largely upon the distribution of wheat crops between importing and exporting countries. But precise measurements of both exportable surpluses and import requirements are not feasible; for crop estimates are subject to an indeterminate margin of error, and not much is known about trends in consumption.

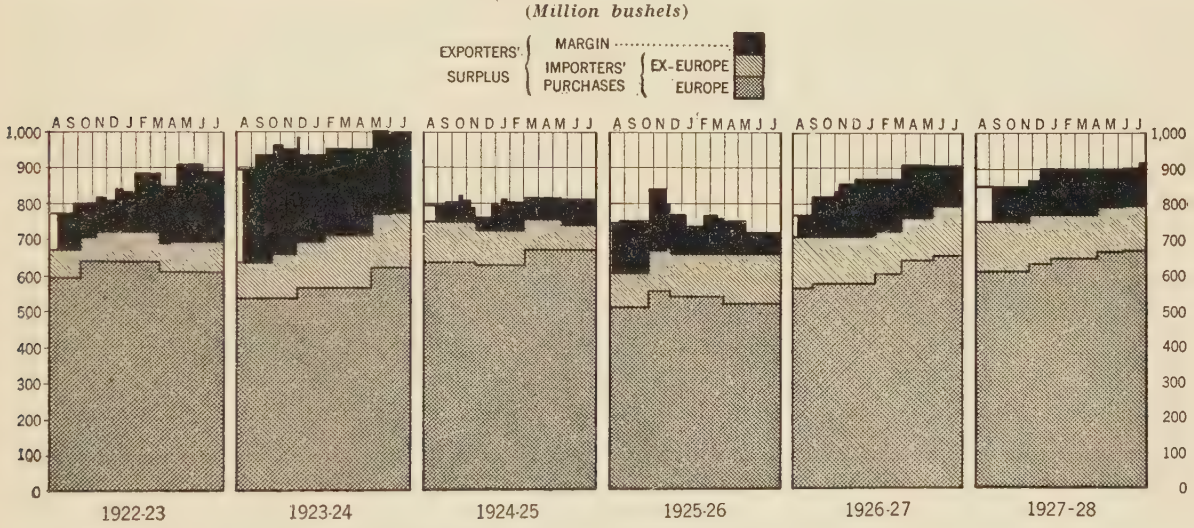
The crop year 1927–28, however, was one in which the international statistical position was relatively easy. The margin between available exportable supplies and supplies required by importing countries to maintain consumption at a normal level was certainly wider than in the three preceding years, though not so wide as in 1923–24 and perhaps 1922–23. Broomhall's successive estimates for the past six years appear in Chart 4. In our judgment the margin of 1927–28 here appears too narrow by comparison with that of 1926–27; in actuality, the margin was presumably wider in 1927–28. Broomhall appears to have underestimated the extent of Europe's demand for wheat in the earlier months of 1926–27,[1] so that the margin in 1926–27 is made to appear wider than in fact it was.

Further evidence bearing on the international statistical position is given in the following rounded figures, which show in million bushels the wheat crops of European importing countries (all Europe except Spain and the four Danube countries) in comparison with the crops of the four leading exporting countries. The latter are adjusted for apparent official underestimates in 1924–26.[2]

	1922	1923	1924	1925	1926	1927
European importers ..	690	830	725	930	760	840
Major exporters ..	1,570	1,640	1,500	1,440	1,675	1,730

In comparison with 1926–27, the year 1927–28 was characterized by considerably larger crops in European importing countries and by somewhat larger crops in the major exporting countries. But these figures, if used without qualification, exaggerate the ease of the statistical position in 1927–28. The margin between exportable

Chart 4.—Broomhall's Successive Forecasts of Exporters' Surpluses and Importers' Purchases, 1922–23 to 1927–28*



* Data from *Corn Trade News*. See Appendix Table XII for 1927–28 figures.

[1] See Wheat Studies, IV, 9.

[2] These underestimates appear to have reached about 15 million bushels in 1924, 65 million in 1925, 55 million in 1926, and 65 million in 1927. See Appendix Table XXXI.

surpluses and import "requirements" was by no means 135 million bushels larger in 1927–28 than in 1926–27, as might at first glance be inferred from the figures given above. European consumption requirements due to growth of population alone apparently increase by some 15 million bushels a year,[1] and per capita consumption is also increasing; ex-European requirements increase by 3 or 4 million;[2] and requirements in the major exporting countries increase by some 15 million.[3] Moreover, Russia proved to have available for export in 1927–28 some 40–50 million bushels less than in 1926–27; and India and the Danube basin had about 15 million less, though Chile and northern Africa had a little more. Allowances merely for these factors suggest that the margin was only about half as large as the crop figures seem to show. Furthermore, the poorer quality of the Canadian and northern European wheat crops, and the smaller European crops of feed grains, served to narrow the margin between exportable surpluses and import "requirements" of wheat still further. All told, exportable surpluses throughout the world, if calculated without reference to changes in wheat stocks, appear to have been no larger in 1927–28 than in 1926–27, principally because of small exportation from Russia. But stocks were relatively low at the opening of 1926–27, high at the opening of 1927–28; hence exportable surpluses in effect were larger in the year under review. With import "requirements" smaller, the statistical position was easier. Once the Canadian crop was assured, the broad fact was fairly clear. After mid-November, Broomhall and other students made few important changes in their estimates during the course of the year;[4] and prices remained relatively stable until new-crop prospects, especially in the winter-wheat belt of the United States, began to exert their influence in the spring.

II. CONSUMPTION

Reliable measurement of the quantities of wheat annually used respectively for human food, for animal feed, and for seed is impossible even in a few countries where the data are fullest; and in most countries even reasonable estimates are rendered difficult by the lack of essential statistics. Calculations are usually uncertain because so little is known about dockage, the feeding of wheat to animals, and changes in stocks of wheat and flour; but in most countries milling statistics also are deficient, and even crop estimates are not trustworthy within narrow limits. The situation is clearer in the major exporting countries than elsewhere, but generalizations, based even on careful study, must be accepted with some reserve. We offer the following provisional statements for what they may be worth, in view of the importance of the subject rather than because our analysis is exhaustive.

Trends of Utilization

The quantity of wheat used for seed must have tended upward during the post-war period, for acreage has increased in most regions (see Chart 2, p. 51), while the quantity sown per acre presumably remains fairly constant. From 1920 to 1927, the wheat area of the world exclusive of Russia and China increased on the average about 3 million acres per year, with fluctuations in the annual totals due principally to changes in the United States. If sowings per acre average 1.5 to 2 bushels, the annual increase in the use of wheat for seed approximates 4–6 million bushels, and the increase for the period may have amounted to 30–45 million bushels. Since the area sown in 1927–28 for the crop of 1928–29 was about 5 million acres larger than the area sown for the crop of 1927–28, seed use of wheat in the world ex-Russia was apparently the highest on record in post-war years; but reduction of the acreage in Russia may have offset the increase elsewhere.

[1] Estimate derived from population statistics and an estimated per capita disappearance of approximately 4.8 bushels per year during 1922–27.

[2] See "Ex-European Trade in Wheat and Flour," Wheat Studies, August 1928, IV, 345.

[3] Based on seed and consumption estimates shown in Appendix Table XXXI.

[4] See Appendix Table XII.

In most countries of the world, wheat consumed for human food apparently has tended since the war to increase not only with growth of population but also per capita. Some rough evidence to this effect is given in Table 4. This table shows apparent increases and decreases in per capita disappearance of wheat—sometimes for human consumption only, sometimes for food, feed, waste, and seed—in terms of annual averages, between the period 1922–23 to 1924–25 and the period 1925–26 to 1927–28. The use of averages serves in considerable degree to eliminate changes in apparent consumption due to changes in wheat and flour stocks; but for all except the major exporting countries, the per capita figures include wheat wasted and fed to domestic animals. Hence in most instances the figures give only an approximation to the trend of human consumption. Interpretation of the data cannot be pressed far in view of possible inaccuracies in crop estimates and population estimates.

TABLE 4.—APPROXIMATE ANNUAL PER CAPITA CONSUMPTION OF WHEAT IN DIFFERENT REGIONS, AVERAGES 1922–25 AND 1925–28*

(*Bushels*)

Country or region	1922–23 to 1924–25	1925–26 to 1927–28	Percentage change
United States[a]	4.22	4.14	— 1.9
Canada[a]	4.56	4.53	— .7
Australia[a]	4.87	4.81	— 1.2
Argentina[a]	4.72	5.42	+14.8
India[b]	1.06	1.00	— 5.7
British Isles[c]	5.90	5.74	— 2.7
France[c]	7.24	7.13	— 1.5
Germany[c]	2.09	2.85	+36.4
Italy[c]	6.49	6.87	+ 5.9
Danube countries[cd]	3.84	4.58	+19.3
Other Eastern Europe[ce]	2.26	2.53	+11.9
Other Western Europe[cf]	4.58	4.74	+ 3.5
Japan[b]	.79	.79	0.0

* Calculated chiefly from population estimates and data shown in Appendix Tables XXIX and XXXI.

[a] Human consumption only. See Appendix Table XXXI.

[b] Disappearance for all categories.

[c] Disappearance for all categories except seed.

[d] Hungary, Bulgaria, Jugo-Slavia, Roumania.

[e] Austria, Czecho-Slovakia, Poland, Finland, Latvia.

[f] Netherlands, Belgium, Denmark, Norway, Sweden, Switzerland.

It is of interest to observe, however, that only in the United States, Canada, Australia, the British Isles, India, and France is there an indication of declining consumption per capita. For all of these countries the declines are so small as to fall within the probable margin of error in the figures; and in India the apparent decline is clearly attributable to three successive large crops in 1922–24 and three successive mediocre ones in 1925–27. Moreover, wheat prices generally averaged lower in the period 1922–23 to 1924–25 than in the period 1925–26 to 1927–28, a situation tending broadly to encourage consumption in the earlier period. Presumably the figures for the earlier period are relatively higher (or those of the later period relatively lower) than would have been true under a constant level of wheat prices. Hence such declines as appear in the figures may have been due partially to this cause, and if so, need not be regarded as evidence of any definite tendency for wheat to be displaced in the diet by other foods.

All other regions show increases in per capita disappearance, and presumably in wheat consumption for human food. The most noteworthy increases have been in Argentina, Germany, and the Danube countries. In so far as price has affected consumption, the upward tendencies are probably understated. Economic recovery in Europe during the post-war period is largely responsible for the widespread increases in per capita consumption, and parcellation of land and larger wheat crops have probably been important influences in Danube countries. But the causes of increasing wheat consumption differ from country to country, and need not receive detailed consideration here. Table 4 here serves merely to emphasize the fact that on the whole wheat consumption per capita throughout the world has tended to increase during the past six years, and to do so in the face of relatively higher prices in the later than in the earlier portion of the period.

On the whole, the crop year 1927–28 was characterized by relatively large utilization for food, feed, and waste. Disappearance was especially heavy in northern and eastern Europe, where rapidly increasing use of wheat for food was supplemented in many countries by an exceptional use of

poor-quality wheat for feed, in part the result of tightness in the feed grain position.

Consumption in Leading Exporting Countries

For the United States, we tentatively estimate consumption of wheat for human food in 1927–28 as 505 million bushels, some 13 million more than in 1926–27 or 1925–26.[1] More wheat was required to produce a barrel of flour than in 1926–27 or 1924–25, when the crops were of better quality, but somewhat less than in any other year since 1920–21.[2] Our estimate, so far as it is in error, presumably overstates rather than understates the fact; the point can be cleared up only with the appearance of census data on mill output in 1927. On account of the large acreage sown for the crop of 1928, wheat used for seed, according to official estimates, reached 94 million bushels, the highest figure in history except for those of 1918 and 1921.

These items plus net exports (including shipments to possessions) and calculable year-end stocks, when deducted from supplies apparently available, leave a residue of some 81 million bushels to cover disappearance in the form of feed and waste, and changes in invisible stocks. Such a figure is much higher than those of 1926–27 and 1925–26 but is roughly in line with those of the three preceding years. How near the truth any of these figures may be is largely a matter of conjecture. Murray estimated that some 3 per cent, or 26 million bushels, of the crop of 1927–28 was fed to livestock on farms.[3] A good deal of unmilled wheat shipped off the farm is fed to poultry every year, and waste in the form of dockage[4] and other loss is certainly appreciable every year. It is probably safe to say that the amount of wheat fed and wasted (including dockage) seldom or never is less than 50 million bushels a year, and usually runs somewhat higher. It is not inconceivable that some 81 million bushels were so used in 1927–28, for dockage was presumably fairly heavy with a large spring-wheat crop, and comparatively high prices of corn and mill offals may have tended to increase the use of wheat for animal feed in 1927–28. But part of the figure may represent increases in invisible stocks.

For the second successive year, the outstanding feature of consumption in Canada was the large quantity of grain unmerchantable and lost in cleaning, officially estimated as 39 million bushels as compared with the previous high figures of 31 million in 1926–27 and 1923–24. If the crop was underestimated, even this high figure is too low; for it is derived from estimates of the percentage of the crop unmerchantable and lost in cleaning. This wheat apparently constitutes the only fraction of the crop which is fed to farm animals. The official estimate of wheat milled for domestic consumption is not yet available. On account of the poor quality of the crop, the milling ratio for all wheat milled reached 4.59 bushels per barrel of flour—the highest of any in the past six years. Hence even if per capita consumption tends to decline slightly, growth of population and the higher milling ratio must have resulted in a larger quantity of wheat ground for domestic consumption than in any preceding year. We tentatively estimate this quantity as 44 million bushels. Because of the large area sown for the crop of 1928, seed use of wheat was presumably somewhat larger in 1927–28 than in any earlier year, about 41 million bushels. All told, total domestic utilization in Canada in 1927–28 reached about 124 million bushels. If these figures and the official data on stocks and net exports are correct, the crop must have been underestimated by some 40 million bushels.

Little can be said of consumption in Australia, particularly because statistics of wheat milled are not yet available for 1927–28. The population is growing slowly, but per capita consumption is apparently tend-

[1] See Appendix Table XXXI.

[2] Wheat required per barrel of flour (census estimates raised 1.5 per cent to account for unreporting small mills) ran as follows in the past eight years, in bushels:

1920–21	4.712	1924–25	4.651
1921–22	4.727	1925–26	4.705
1922–23	4.701	1926–27	4.639
1923–24	4.700	1927–28	4.689

[3] Circular of Clement, Curtis, and Co., Chicago, March 1, 1928.

[4] Strictly speaking, dockage is not wheat, but since it is included in wheat as shipped it must be regarded as wheat in considering the disposition of the reported crop.

ing to decline slightly. The difference from last year probably did not exceed half a million bushels, and in rounded figures we estimate wheat consumed for human food as 30 million bushels, the same as in 1926–27. Seed use was presumably unusually large, since the area sown for grain alone for the crop of 1928 is estimated as 14 million acres; if, as usually occurs, somewhat over a million acres were sown for hay, seed use of wheat in 1927–28 must have approximated 14 million bushels.

In Argentina, consumption of wheat for human food has increased rapidly in recent years. According to official data,[1] flour production minus net exports of flour were 799,351 tons in the calendar year 1922, and 1,124,641 tons in 1927. Unless flour stocks were greatly increased over the interval, as seems improbable, wheat ground for human consumption totaled approximately 59 million bushels in the crop year 1927–28, as compared with 57 million in 1926–27 and only 49 million in 1923–24. Seed use of around 25 million bushels was also the largest in recent years, unless the poor quality of the crop of 1925 increased the quantity required per acre in sowing the crop of 1926. The quantity of wheat fed to animals and wasted is not accurately measurable in any year. It was presumably exceptionally high in 1925–26 and somewhat high in 1926–27, following the distinctly poor-quality crop harvested in December 1925–January 1926. But in 1927–28, with the crops of 1926 and 1927 both of good quality, wheat fed and wasted was presumably a small item in Argentine disposition. If wheat used for seed and human food reached 84 million bushels, stocks on August 1, 1928 some 70 million, and net exports 178 million, total disposition in Argentina approximated 332 million bushels. The crop was estimated as 239 million, and our estimate of stocks (subject to a margin of error unlikely to exceed 10 million bushels) on August 1, 1927 was some 65 million. Hence only about 304 million bushels of wheat appear to have been available in Argentina, as against 332 million disposed of. This calculation suggests that the crop of 1927 was underestimated by 20–40 million bushels.

[1] See *Revista Seminal*, September 18, 1928, VII, 20.

Consumption in Minor Exporting Countries

Not much is known of consumption in India. The crop of 1927 was only of moderate size; but net exports were small, and domestic retention of wheat for all uses approximated 326 million bushels. The figure is 13 million above that of 1926–27, and a little higher than those of 1924–25 and 1925–26. Seed use must have been somewhat higher than in earlier years in view of the record acreage of the crop of 1928. On the whole, 1927–28 appears to have been a year of normal consumption in India. There was no such decrease as occurred in 1921–22, following a short crop, and no such increase as in 1923–24, when a large crop and low world wheat prices acted to encourage domestic consumption.

The situation in Russia is difficult to appraise, despite considerable statistical data. Table 5 (p. 58) summarizes available pertinent material, including the latest revisions of crop and acreage estimates. These figures indicate that per capita wheat disappearance for food, feed, and changes in stocks approximated 4 bushels or more in each of the past three years. There can be no doubt that the years 1920–21 to 1924–25 were years of distinctly short crops both of wheat and rye, and were accompanied by reduced consumption and persistently low stocks. The years 1925–26 to 1927–28, with much larger crops, were undoubtedly characterized by heavier consumption than occurred during the preceding period.

But the broad question, whether or not wheat production and consumption in Russia have in recent years returned to the pre-war level, remains unsettled. In the first place, per capita disappearance of wheat in pre-war years (and within pre-war boundaries) may have averaged nearer to 3.50 than to 2.94 bushels, if pre-war crops were as far underestimated as some Soviet officials suppose. In the second place, some of the wheat available for consumption during the three years 1925–26 to 1927–28 may have been used to build up stocks abnormally depleted during the preceding five crop years; the assumption is by no means unreasonable. If so, per capita disappearance for the past three years may

actually have averaged below 4 bushels, though perhaps not so low as 3.5 bushels. Nevertheless, the evidence suggests that actual consumption of wheat in Russia during the past three years at least equaled and perhaps exceeded the pre-war average. During recent years a decided drift toward wheat consumption and away from rye production has been noted.[1]

TABLE 5.—WHEAT DISAPPEARANCE IN RUSSIA, PRE-WAR AND POST-WAR, CARRYOVERS DISREGARDED*

July–June	Acres (Million acres)	Production (Million bushels)	Seed requirements[a] (Million bushels)	Net exports (Million bushels)	Domestic supplies (Million bushels)	Estimated population[b] (Millions)	Apparent per capita consumption (Bushels)
1909–13[c]	78.0	815.0	149.7	160.1	505.3	171.9	2.94[c]
1923–24	39.2[d]	419.1[d]	98.1	21.4	299.7	136.7	2.19
1924–25	52.7[d]	472.3[d]	111.2	0.3	360.8	140.0	2.58
1925–26	59.8	729.9	131.8	27.1	571.0	143.3	3.99
1926–27	70.9	819.6	141.2	49.2	629.1	146.4	4.30
1927–28	75.9	749.0	124.1	7.0	618.0	149.8	4.13
1928–29	66.7	859.8	.....	.....	.....	.....	....

* Based chiefly on data in *Foreign Crops and Markets*, March 26, 1928, XVI, 405. Latest revisions of acreage and production substituted for figures there shown.

[a] Calculated by multiplying acreage of succeeding year by seed requirement of 1.86 bushels per acre.

[b] Derived from data on domestic supplies and per capita consumption given by U.S. Department of Agriculture. The figure for 1923–24 is extrapolated.

[c] All data for pre-war boundaries. Soviet officials regard the production figure as too low by some 90 million bushels. To accept this view implies a per capita consumption of somewhat less than 3.5 bushels.

[d] Data reported by International Institute of Agriculture.

The year 1927–28 was apparently characterized by heavy consumption in Russia. Official estimates suggest that stocks were built up during the course of 1926–27, and most observers suppose that a reduction occurred in 1927–28. If such changes occurred, per capita disappearance may have been larger in 1927–28 than in 1926–27, not smaller, as Table 5 suggests. But possible revisions of crop and acreage data may alter the picture given in the table; and evidence respecting the direction of changes in wheat stocks is not altogether conclusive.[2]

It is of interest to observe that, although per capita wheat consumption in Russia appears to have reached or passed above the pre-war level, exports have remained small. There is at present no method of anticipating whether or not exports will ever reach the pre-war figures. If population continues to increase as rapidly as the figures of Table 5 suggest, if replacement of rye by wheat in the Russian diet proceeds further, if the pre-war level of wheat acreage has not yet been reached, if wheat stocks have not yet attained normal proportions, and if facilities for transporting grain remain decidedly imperfect, then the return of Russia as a heavy wheat exporter can be only remotely in prospect. On all of these points the evidence is still inconclusive; but such evidence as there is suggests that decidedly large exports from Russia can reasonably be anticipated only in years when yield per acre is unusually high in the regions immediately adjacent to Black Sea ports.

As we have seen, per capita consumption of wheat is apparently tending upward more rapidly in the Danube countries than elsewhere in Europe, Germany perhaps excepted.[3] The following figures, in million bushels, show apparent domestic utilization (crop minus net exports) in these countries in the past two years and in terms of averages for 1922–23 to 1924–25 and 1925–26 to 1927–28:

Country	1922–25 average	1925–28 average	1926–27	1927–28
Roumania	83.6	94.6	99.7	89.2
Hungary	46.2	53.3	53.0	55.1
Jugo-Slavia	49.0	61.4	61.7	55.4
Bulgaria	27.1	38.8	34.3	45.2
Total	205.9	248.1	248.7	244.9

[1] See indexes of per capita wheat and rye consumption in urban and rural areas as computed by Professor Lossitzky and quoted in U.S. Department of Agriculture, *Foreign Crops and Markets*, March 26, 1928, XVI, 396.

[2] See below, pp. 67 f.

[3] See Table 4, p. 55.

In all four countries domestic utilization was appreciably higher in 1927–28 than in the period 1922–25. In Hungary and Bulgaria the figures were higher than ever before: both countries harvested large wheat crops, and short crops of corn may have contributed somewhat to increased wheat consumption. Some increase in stocks may have occurred, though the evidence is not clear. Relatively short wheat crops in Jugo-Slavia and Roumania made for lower apparent domestic utilization in 1927–28 than in the two preceding years; but that human consumption was smaller is doubtful. Stocks in these countries were apparently built up in 1925–26 and 1926–27, and at the same time poor quality presumably encouraged the feeding of wheat to animals; whereas in 1927–28 good quality wheat, short crops of corn, and (possibly) reductions in stocks may have combined to maintain human consumption of wheat.

Consumption in European Importing Countries

A broad view of apparent domestic utilization of wheat in European importing countries (excluding Greece, Portugal, Esthonia, and Lithuania) is given by Table 6. The heavy apparent consumption of wheat during 1927–28 in Germany and all other importing countries of northern and eastern Europe is striking. Total available supplies in these countries were 474 million bushels in 1925–26, 480 million in 1926–27, and 539 million in 1927–28.

Improving economic conditions making effective a growing taste for wheat bread, increasing population, smaller crops of rye and feed grains, and to some extent lower wheat prices are factors jointly responsible for the relatively high domestic disappearance of wheat in this group of European countries in 1927–28. There is no evidence that stocks, except in Germany, were built up appreciably more than during the two preceding years. But not all of the 59 million bushel increase over 1926–27 can reasonably be accounted for by reference to these factors. Unfortunately the quantities of wheat unfit for milling, and hence used for animal feed and industry, cannot be determined with precision; but that the quantity was larger than usual in 1927–28 seems certain. If so, human consumption of wheat, especially in Germany, was not so much larger in 1927–28 than in the two preceding years as the bare figures suggest; but the presumption remains that, in continuation of an upward trend, human consumption in central and eastern Europe was larger than ever before.

Table 6.—Apparent Domestic Utilization of Wheat in Certain Countries and Regions of Europe*

(*Million bushels*)

Country or region	1922–25 average	1925–28 average	1925–26	1926–27	1927–28
France	319	319	341	294	323
Italy	277	300	309	307	285
British Isles	285	281	264	289	289
Spain	135	151	162	146	144
Germany	139	191	176	187	209
Western countries[a]	102	110	106	107	118
Scandinavia[b]	42	44	42	41	48
Eastern countries[c]	133	153	150	145	164
Total	1,432	1,549	1,550	1,516	1,580

* Based on data in Appendix Table XXIX.

[a] Belgium, Netherlands, Switzerland.

[b] Norway, Sweden, Denmark.

[c] Czecho-Slovakia, Poland, Austria, Finland, Latvia.

In France, apparent domestic utilization of 323 million bushels was seemingly nearly 30 million bushels larger than in 1926–27, though not so large as in 1925–26, when the domestic crop was of record size for post-war years and domestic wheat prices were low. Comparisons between the past two years are obscured by several factors. During 1926–27, stocks were built up, but net imports were understated to an indeterminate extent. During 1927–28, stocks apparently changed little, but net imports were overstated.[1] With adjustment for these factors, supplies apparently available for consumption may have been little if any higher in 1927–28 than in 1926–27. But quality is known to have been so poor in 1927–28 that much wheat was unmillable on account of the wet weather during harvests; and if unmillable wheat amounted to 10–20 million bushels, as observers have assumed, then supplies available for consumption in all categories must have been smaller, not larger, in 1927–28 than in 1926–27. But even so much cannot be said with assurance in view of conflicting opinions

[1] See below, p. 80.

respecting the official crop estimate,[1] which may be too low for both years. It is of interest to observe that, if official crop estimates are correct, available wheat supplies in France averaged 337 million bushels annually over the three years 1923–24 to 1925–26, but only 308 million over the two past years. So great a decline can be explained partly by the higher average level of prices in the past two years, in part by an observed tendency toward substitution of more expensive foods, notably meat, for bread in the diet,[2] and in part by the exceptionally large crop of 1925–26.[3] Moreover, French bread consumption is so heavy that one would expect it to decline rather than to increase. Alternative interpretations of the data on available supplies, then, are (1) that declining per capita wheat consumption in France accounts for reduced available supplies in the past two years, while official crop estimates are substantially accurate; and (2) that per capita consumption could not have declined so extensively as the domestic utilization figures suggest, if at all, and that official crop estimates have been too low in the past two years. There is probably truth in both hypotheses, but which of the two fits the facts better is difficult to say.

Available supplies in Italy totaled 285 million bushels in 1927–28 as against 307 million in 1926–27. That so considerable a reduction in consumption, if any, actually occurred is nevertheless doubtful. Stocks, after having increased considerably in the course of 1926–27, were reduced in the course of 1927–28; the corn crop was shorter; wheat prices were lower; and the trends are upward in population growth and apparently in per capita wheat consumption. These factors made for heavier consumption in 1927–28 than in 1926–27. On the other hand, revaluation of the lira in April 1927 was followed by increased unemployment and lower wages; and these factors together with exceptionally low prices of rice and a good deal of propaganda directed toward increasing the consumption of that cereal, may have tended to reduce wheat consumption. To evaluate the various influences on wheat consumption is of course impossible; but on the whole the evidence suggests that actual consumption of wheat in Italy could not have been much smaller in 1927–28 than in 1926–27.

In the British Isles wheat crops plus net imports totaled 289 million bushels, the same as in 1926–27, and only 4 million above the average for 1922–25 and 8 million above the average for 1925–28. Unemployment appears to have been on somewhat the lowest level since 1923–24; wheat prices both of native and of imported wheats were the lowest in four years; an unusually large proportion of the domestic wheat crop was thought to be unfit for milling; and population presumably increased. These factors would make for larger domestic utilization of wheat in 1927–28 than in 1926–27, and identical figures for the two years seem explicable only on the assumption that stocks were reduced or that per capita wheat consumption is tending to decline. Port stocks showed an increase, though a smaller one than occurred in the course of 1926–27; but the evidence suggests that other stocks were reduced during 1927–28. Hence, if unmillable wheat was considerably larger in amount in 1927–28 than in 1926–27, whereas human consumption of wheat was smaller, the decline in human consumption seems attributable only to a rather persistent tendency for bread to be displaced in the British diet by other and more expensive foods.

Domestic disappearance of wheat in Spain, carryovers disregarded, necessarily varies directly with the size of the domestic crop. In recent years the tariff has been extremely high; imports have been prohibited in most years; and exports of appreciable size have been impossible. Under the rigid governmental regulation of the grain trade, only changes in crops and in stocks can affect Spanish consumption; and little is known of changes in stocks.

[1] See WHEAT STUDIES, IV, 44, 108 n., and *Foreign News on Wheat*, October 20, 1928, p. 8.

[2] See M. Georges Lefebvre in *Bulletin des Halles*, November 27 and 28, 1927.

[3] Regulations requiring admixture of other cereals with wheat flour were perhaps more stringent in the past two years than in the preceding, and may have tended to restrict consumption. French regulations since 1922 have involved high rates of extraction by mills, together with admixture of various other cereals with wheat flour. Admixture requirements were 8 per cent in 1923–24 and 1924–25, but were substantially reduced in 1925–26; they were 10 per cent in 1926–27 and 6 per cent (after September 10) in 1927–28.

III. STOCKS AND CARRYOVERS

A Broad View

Wheat and flour stocks at any time occupy many different positions—on farms, in country elevators, in transit, in terminal elevators, on piers and afloat, in mills, in jobbers' warehouses, in bakeries, and in households. For several of these positions statistics are either incomplete or entirely lacking, even in countries having the fullest data; and for most countries the available data are decidedly fragmentary. Accurate comparisons of stocks in all positions, in any one country or in the world as a whole, are therefore impossible. But the importance of the subject justifies inexact comparisons.

At the beginning of the crop year 1927–28, as we have noted, commercially significant stocks of wheat and flour stood at an unusually high level, though perhaps exceeded by those on August 1, 1924. These readily calculable items, in the aggregate, ran on a high level throughout the year, seasonal factors considered. In the closing months, as we shall see (p. 73) the size of these stocks became a factor of major importance in the decline of wheat prices, and at the end they were higher even than at the end of 1923–24. Such fragmentary evidence on other stocks as we have been able to gather, however, points to the conclusion that these other items, in the aggregate, were neither very high nor very low during the year, but declined from the beginning to the end by as much as, or perhaps slightly more than, the more prominent group increased. All told, world stocks were relatively high at the beginning and end of the crop year 1927–28, much as they were at the end of the crop year 1923–24, and distinctly higher than they were in the intervening years; but the net change during 1927–28 was comparatively slight, and possibly downward.

Table 7 shows our estimates of stocks in the four principal exporting countries and afloat for Europe for the past six years. Wheat stocks in these positions appear to have been over 25 million bushels larger on August 1, 1928, than on August 1, 1927;[1] and somewhat larger even than the previous high figure of 1924. The greater part of the increase is accounted for by the higher Canadian figure.

But this increase may have been offset by a decrease in stocks of import wheat and domestic wheat in Europe. European net imports in June and July were considerably smaller in 1928 than in 1927 both in absolute amount[2] and in proportion to the annual total; hence, on the assumption that no change occurred in the seasonal course of wheat consumption, less wheat was available from which stocks of import wheat could have been built up. Earlier

Table 7.—Approximate Carryovers of Wheat in Exporting Countries and Afloat, August 1, 1922–28*

(*Million bushels*)

Location	1922	1923	1924	1925	1926	1927	1928
United States ...	130	151	165	135	111	138	142
Canada	36	29	41	26	35	48	75
Argentina	61	65	66	56	61	65	70
Australia	27	42	38	36	30	41	33
Afloat for Europe	49	39	42	33	39	46	45
Total	303	326	352	286	286	338	365

* Summarized from Appendix Tables XXV and XXXI; includes some estimates, as indicated in notes to these tables. United States data as of July 1.

[1] Other comprehensive estimates of stocks in these positions also indicate an increase. The U.S. Department of Agriculture, employing less complete data, estimated that July 1 stocks in similar positions and in United Kingdom ports increased from 323 to 346 million bushels (see *Foreign News on Wheat,* August 20, 1928, p. 12). The monthly statement of visible supplies in similar positions as of August 1 showed an increase from 173 to 217 million bushels (see Appendix Table XXV). The differences between the three sets of estimates arise partly from differences in dates, but chiefly from differences in methods of evaluating Argentine and Australian stocks. For these countries we attempt to measure stocks of wheat and flour in all positions; the Department of Agriculture attempts to measure stocks available for export and carryover, but not for domestic consumption; Broomhall attempts to measure only visible supplies. In addition, Broomhall's figures fall far below ours and the Department of Agriculture's because he disregards farm and city mill stocks in the United States.

[2] Excluding Greece, Portugal, and Spain, for which data are not available, June–July net imports of all other European countries totaled 129 million bushels in 1927, and 104 million in 1928; they were 20.3 per cent of the crop year total in 1927, and 16.6 per cent in 1928. These figures overstate the contrast, however, because French net imports in 1926–27 as a whole were understated, the imports of 1927–28 overstated, and the imports of June–July 1927 overstated.

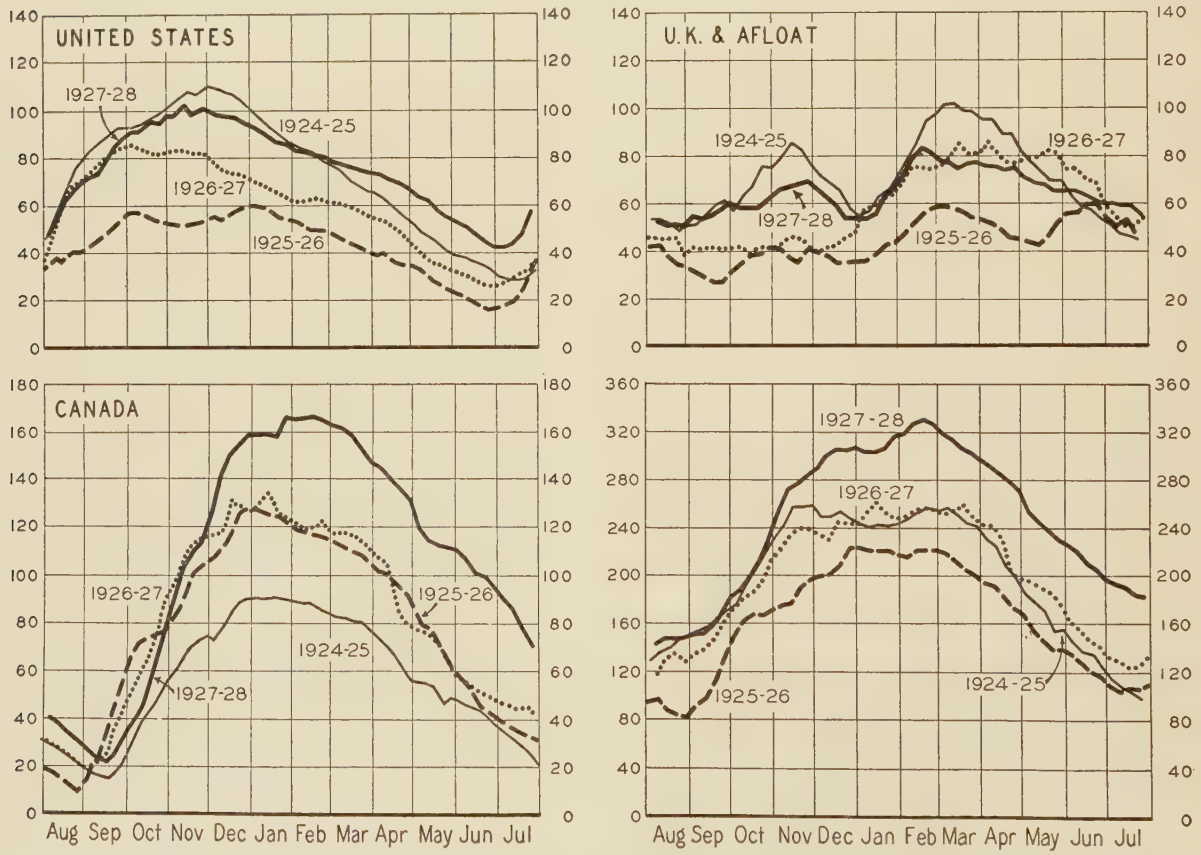
harvests this year than last made imports less necessary in the closing weeks of the crop year. Moreover, in countries where hedging is not extensively practiced, bakers and millers tend to withdraw from the market and to reduce their stocks to a minimum during a period of declining prices such as occurred in May–July 1928—a decline considerably more drastic than that of June–July 1927. Finally, Russian purchases of wheat in July 1928, which were apparently effected chiefly in continental ports, must have drawn down import wheat stocks to some extent. In spite of evidence that certain elements of import wheat stocks in France and the United Kingdom and perhaps in Poland were higher on August 1, 1928, than on August 1, 1927, we infer that stocks of import wheat and flour in all positions in Europe, though by no means extraordinarily low, were lower at the end of this year than at the beginning to an extent that went far toward counterbalancing the increase in stocks in exporting countries and afloat. In Europe ex-Russia as a whole, supplies of native wheat may also have decreased somewhat on balance, though the evidence is not altogether clear. Stocks in Russia seem to have been reduced, and a succession of crops of moderate size favored a decrease in India.

Visible Supplies

The weekly course of visible supplies in the United States, Canada, United Kingdom ports, and afloat for Europe during 1927–28 and the three preceding years is shown in Chart 5. United States visibles vary from year to year in accordance with the size of

Chart 5.—Visible Wheat Supplies in the United States, Canada, and United Kingdom Ports and Afloat to Europe, Weekly from August 1924*

(*Million bushels*)



* Data from *Grain World, Northwestern Miller, and Canadian Grain Statistics.* The fourth section of this chart shows the aggregate of the other three items.

the wheat crop, especially spring wheat;[1] the rapidity of the movement from farms; and the rapidity of the export movement. They are influenced by prices, and exert some influence upon prices. Higher visibles in 1927–28 than in 1926–27 are accounted for partly by the larger crop of spring wheat in 1927, partly by more rapid marketing, and partly (especially in the latter half of the year) by more restricted exportation. Until February 1928, visibles were higher than in any of the three preceding years except 1924–25.; thereafter, they were higher even than in 1924–25. The contrast between these two years, in which the wheat crops were of much the same size, is striking. Receipts at primary markets[2] during August 1924–January 1926 totaled 385 million bushels, 55 million bushels more than during the same period of 1927–28. Net exports during these periods totaled 184 million bushels in 1924–25, and 147 million in 1927–28; hence heavier marketings in the earlier year were not counterbalanced by exports equally large, and visibles ran higher. But in February–June 1928 primary receipts totaled 108 million bushels as against 87 million in 1925; and net exports totaled only 32 million as against 63 million. Consequently the more rapid marketing and less rapid exportation in 1927–28 resulted in higher visible supplies in the latter months of the year. These heavy accumulations were fundamentally due to unusually wide spreads between domestic and international wheat prices. During February–April prices in the United States rose more rapidly than elsewhere, encouraging heavy marketings by farmers; and decreasing spreads between Chicago and Liverpool prices made sales for export difficult.[3]

A noteworthy feature of the visible supply situation in 1927–28 was the unusually heavy accumulation of stocks at Duluth-Superior and Minneapolis.[4] Another feature was the rapid increase of visibles in July 1928, as large quantities of winter wheat from the new crop were marketed from fields harvested with the combined harvester-thresher. Wheat appears not to have ripened especially early, but the combine was used more extensively than ever before.

Note on the Harvester-Thresher Combine

Practical experiences with this device are now sufficiently prolonged in time and extensive in area to warrant a tentative judgment on the innovation. The widespread introduction of the combine constitutes a revolutionary factor in wheat growing in North America. But the combine, like other outstanding improvements in mechanization, is not proving an unqualified benefit to wheat growers or to the grain. In fact, the pressing problem of the wheat belt from the Panhandle of Texas to the Peace River region of Alberta is to retain and develop the advantages of the combine while avoiding the disadvantages.

At the recent Wheat Improvement Research Conference held in Manhattan, Kansas, the statement was made that with the use of the combine in harvesting and threshing wheat, together with the corresponding changes in plowing, fallowing, and seeding with the tractor, the savings would average as much as three dollars per acre. When one considers that, according to the United States Department of Agriculture, the operative cost of planting and harvesting the acre of wheat runs between eight and nine dollars, a saving of three dollars would represent an outstanding achievement. Whether in fact the potential or actual economy is so large as this, it is certainly large under favorable circumstances. Against the saving, however, stand certain demonstrated disadvantages, affecting both yield and quality of the wheat.

The combine method of harvesting wheat requires a stiff straw; the stand must resist lodging before cutting and must endure the mechanical handling of the machine. Secondly, the head must be non-shattering, if heavy losses are to be avoided. Our present wheats clearly do not satisfy these requirements; up to the present, relatively heavy losses have occurred in harvesting, varying from region to region and from variety to variety. Stiff straw and resistance to shattering have long been among the objectives of wheat breeding. The combine has made these desiderata still more important.

[1] The proportion of the spring-wheat crop passing through terminal elevators in the Northwest, and hence measured in the visible, is apparently larger than the proportion of any other class of wheat passing through terminals in other regions. There is less milling at country points in the Northwest than elsewhere.

[2] See Appendix Table XV.

[3] See below, p. 73.

[4] The Chicago Board of Trade visible supply figures, which are somewhat smaller than Bradstreet's, were as follows on June 30 of the past six years, in thousand bushels:

Year	Duluth and Minneapolis	Total United States	Year	Duluth and Minneapolis	Total United States
1923	16,567	26,313	1926	4,511	12,325
1924	10,456	34,901	1927	8,316	22,107
1925	12,818	29,146	1928	23,116	38,922

Equally important are considerations of quality. In a stand of wheat ripe for harvest, the moisture content in the kernels rises during the night and is lowered by transpiration during the day; at daybreak it may be several per cent higher than at sundown. Wheat harvested during the forenoon has a higher moisture content than wheat harvested during the afternoon; harvested early in the day, it is likely to have a moisture content so high as to provoke heating in the bin unless watched and treated. Heavy losses are known to have occurred from such bin burning; and the juice of green weeds crushed during the threshing, and the high water content of green weed seeds, accentuate the danger of heating in the bin.

Attempts are being made to combat high moisture content by installation of a small heater on the combine, by sprinkling a dessicating powder over the wheat directly after threshing or when placed in the bin, and by cutting the wheat first like hay and passing it through the thresher a few hours later. These solutions of the problem do not strike us as practicable over large areas. It is better to clean the wheat immediately after threshing (something desirable in itself) and to store it in self-ventilating bins or to pass it through a blower in an elevator. Combine-harvested wheat must be treated more like corn. But this solution implies extensive construction of suitable self-ventilating storage bins both on farms and in country towns.

Lastly, unless measures are taken to the contrary, the use of the harvester-thresher is attended with heavy marketing of wheat during the harvest months, intensifying the usual strain upon transport and elevator facilities and the seasonal pressure upon prices. Restraint in the marketing of wheat threshed from the shock or from the stack is advisable. Restraint in the marketing of wheat threshed immediately after cutting will be found still more advantageous.

The extremely high Canadian visible supplies in 1927–28 were of outstanding significance. Although the crop was one of the two largest in history, the harvest was greatly delayed; hence marketings were smaller than usual in September and early October, and visible supplies until late November remained rather low in view of the large crop. But marketings in November–February were of huge volume, larger even than in 1923–24; and net exports, principally because early closing of navigation on the Great Lakes hampered the movement, were not large enough to reduce the visible. From December 1927 through the remaining months of the crop year the Canadian visible loomed large in the eyes of traders, and the carryover at the end of the crop year proved the largest in history.

Whether or not the visible was maintained at high figures principally through the activities of the Canadian Pool is an interesting question, but one not susceptible of definite answer by outsiders. The Pool could not prevent the wet harvesting weather which delayed marketing and curtailed exportation, in part by creating the necessity for huge quantities of grain to be passed through dryers. The Pool could not prevent an early close of navigation. It did not restrict the export movement through Vancouver and by rail during the winter months, if the size of these movements is a criterion. And it could not prevent the late opening of navigation in the spring, which precluded heavy exportation in April. Hence it is difficult to perceive how the Pool could have effected an appreciable reduction in Canadian stocks from August 1927 to April 1928. But rising prices during February–April, and the possibility of still higher prices, may have caused the Pool somewhat to restrict sales for shipment after the opening of navigation.[1] At some time after prices broke in early May, Pool offers appear to have been pressed decidedly; Canadian net exports, at least, were of record volume during May–August, and selling pressure was frequently commented upon in European journals. Thus there seems reason to believe that the exceptional year-end visibles in Canada were due to Pool operations only in so far as forward sales may have been deliberately restricted during April and May. This policy may have been misguided in the sense that higher prices might have been obtained had more sales been made in April and fewer in July; but at the time a policy of restricted sales appeared to be warranted by the poor winter-wheat prospects in the United States and Europe. With spring wheat sown and progressing favorably, and winter-wheat prospects improving, the huge

[1] In its *Director's Report* for 1927-28, p. 7, the Pool states that "Our policy last year, in view of the comparatively low intrinsic value of the crop and the possibility of a high quality crop being harvested, was to keep well sold up. Nothing happened during the year to make us alter this policy. . . . ." It is interesting to observe that sales of 24.2 million bushels were made in February, 25.6 million in March, but only 22.6 million in April; and that sales in May were smaller than those of June. But not much information can be gained from these sales figures, for they presumably include sales of futures and sales for shipment in distant months.

Canadian visible became a price-depressing factor of considerable significance.

Visible supplies afloat for Europe and in ports of the United Kingdom were naturally large in 1927–28 because shipments were heavy. Only in 1924–25, a year in which the distant exporters, Australia and India, were heavy shippers, were these visibles on a higher level. They were larger during August–December 1927 than in the same period of 1926, for in the earlier year shipments had been greatly restricted by a bulge in ocean freight rates which caused importers to curtail their purchases. In January–June 1928 these visibles were lower than in the preceding year, because with lower freight rates in the early months of 1927, shipments and afloat stocks alike became extraordinarily high.

The concordance of high visibles in Canada, the United States, and afloat, but especially in Canada, made for record totals. The highest figures reached in the preceding six years had been recorded in 1923–24, when from January to March 1924 total visibles ranged from 260 to 275 million bushels;[1] but in 1927–28 the total ranged from 305 to 330 million bushels during most of the December–March period. Such ample supplies in sight in North America and afloat positions together with a large Argentine wheat crop contributed to the stability of wheat prices in the winter months and to the resistance of international prices to the spring advance in the United States and Canada.

Outward Carryovers in North America

Principally on account of the large increase in Canadian stocks during 1927–28, the outward carryover in North America (July 1 in the United States, August 1 in Canada) was undoubtedly the largest in recent years. The figures are as follows, in million bushels:

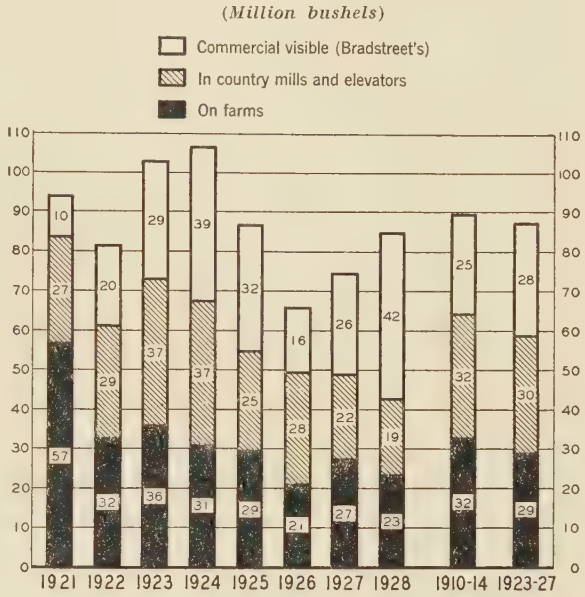
1923	180	1926	146
1924	206	1927	186
1925	161	1928	217

[1] See Chart in Wheat Studies, II, 32.

[2] Apparently, however, the distribution of the crop among its various classes was also effective. Country mill and elevator stocks were exceptionally low in states east of the Mississippi, where the soft red winter-wheat crop of 1927 was distinctly small, rather than in the states west of the Mississippi.

A partial statement of the United States carryover is given in Chart 6, which shows the Department of Agriculture's estimates of stocks on farms and in country mills and elevators together with Bradstreet's commercial visible. Stocks on farms were the lowest since 1919, except in 1926, as a result of exceptionally heavy marketings induced by the high prices of April–May. The exceptionally low stocks in country mills and elevators, only 18.9 million bushels as compared with a 5-year average of 29.9 million, were perhaps affected by the same factor.[2]

Chart 6.—Wheat Stocks in the United States, July 1, 1921–28, with Comparisons*



* Official data except Bradstreet's visible, as tabulated in Appendix Table XXIII. Country mill and elevator figures for 1926–28 are estimated on a new basis, and probably are not strictly comparable with figures for earlier years.

But visible supplies as of July 1 were 42.2 million bushels, larger than in any year since the war. Hence the carryover consisting of these three items was 85 million bushels, some 10 million larger than that of 1927 and about average in size.

A closer approach to the total United States carryover is afforded by the addition of the Census Bureau's reports of stocks held by city mills. Data of the four years for which they are available are summarized in Table 8 (p. 66). Flour stocks were slightly higher than in any of the three preceding years. Wheat stocks of 46 million

bushels were somewhat lower than those of 1927, but higher than those of 1925 and 1926, as were total stocks of 63 million. The total United States carryover calculated to include city mill stocks (except those in country elevators and public terminal elevators, in order to avoid duplication with country mill and elevator stocks and visible supplies elsewhere reported) reached 142 million bushels. As compared with 138 million in 1927, 111 million in 1926, and 135 million in 1925, the figure does not appear remarkably high.[1]

TABLE 8.—UNITED STATES CENSUS REPORTS ON MILL STOCKS OF WHEAT AND FLOUR, JUNE 30, 1925–28

(*Million bushels*)

	1925	1926	1927	1928
Wheat:				
Country elevators	2.16	2.52	2.56	1.90
Public terminals	3.44	3.00	3.88	3.68
Private terminals, in transit, and in mills	26.72	30.32	46.15	40.50
Total	32.32	35.84	52.59	46.08
Flour as wheat[a]	15.73	14.67	16.76	17.08
Grand total	48.05	50.51	69.35	63.16

[a] Barrels of flour converted at 4.7 bushels per barrel.

The outward carryover of Canadian wheat (exclusive of flour) on July 31 was officially placed at 76.5 million bushels in all positions.[2] This is by far the largest figure since data have been compiled, presumably the largest in history, and 26 million bushels larger than the heavy carryover of last year. Stocks in elevators and in transit, 67.3 million bushels, were distinctly large. Transit stocks alone reached 13.7 million bushels, more than twice as high as any other recorded figure. Some 9 million bushels of this wheat was afloat on the Great Lakes, apparently moving to export via Montreal — a quantity distinctly unusual for the end of the Canadian crop year. The Pool seems to have had no carryover, at least in the sense of ownership; but some 6.1 million bushels apparently remained in the physical sense in Pool elevators at Port Arthur alone on August 3.[3]

Southern Hemisphere Stocks

Wheat stocks in Argentina have been estimated directly only twice in recent years; ordinarily the official statements of exportable surpluses consist merely of subtraction of estimated seed and consumption requirements from the estimated crop, and further subtraction of reported exports. But as of August 21, 1926, a direct official estimate of stocks in all positions was made;[4] and as of June 30, 1928, an unofficial estimate was made of stocks in ports, in railway stations, and on farms.[5] The latter figure reached 78 million bushels. But it is too low by comparison with the official figure of 55 million bushels for August 21, 1926, since it includes no estimate of stocks in mills and bakeries, which constituted 30 per cent of the earlier official estimate. Adjusting the unofficial estimate for wheat exported and consumed domestically during the month of July, we reach a figure of 54 million bushels as stocks on August 1, 1928; and this figure raised by 30 per cent to 70 million bushels seems to yield as close an approximation as can now be secured to total Argentine stocks on August 1. The figure is higher than figures for other years[6] reached on calculations of net exports and domestic consumption during August–December (including a rough assumption that stocks on January 1 remain constant at 10 million bushels); but a high figure is not unreasonable in view of the relatively heavy exportation during August–November 1928. The whole subject of Argentine stocks remains obscure, and we regard our estimates as tentative. But there seems little reason to doubt that stocks on August 1 were large rather than small, despite the heaviest January–August export movement in history.

Australian stocks also are not directly estimated. Broomhall placed the Australian visible supply on August 1, 1928, at 9.5 mil-

[1] Sydney Anderson, president of the Millers' National Federation, has calculated the total United States carryover as 175 million bushels. This calculation employs probably too low a figure (40 million bushels) for feed and waste.

[2] See Appendix Table XXIII.

[3] See *Directors' Report, 1927–28*, p. 7, and *Canadian Grain Statistics*, August 3, 1928.

[4] The full official report appears in *Revista Seminal* September 14, 1926, pp. 2–4, 22.

[5] Reported in *Times of Argentina*, July 16, 1928, p. 34.

[6] See Table 7, p. 61.

lion bushels, as against 12.7 million in 1927. But the visible supply does not constitute a large proportion of total stocks, and may perhaps fluctuate differently from year to year. Accepting official crop estimates and estimating other items of disposition directly, we reach a figure of about 33 million bushels for stocks on August 1, 1928, as against 41 million a year before. The figure is somewhat lower than those of other years except 1926 and 1922, but relatively low stocks are usually to be expected after a small crop.

European Stocks

The limited statistical evidence available to us respecting stocks of import wheat in European countries relates to the United Kingdom and France. Broomhall estimated stocks in ports of the United Kingdom[1] on August 1, 1928 as 10.1 million bushels, somewhat the highest figure since 1920, and 2.3 million above those of 1927. Stocks of wheat and flour in customs warehouses in France on July 31 were officially placed at 1.61 million bushels, the highest since 1924.[2] But these quantities must represent only a small fraction of import stocks in all positions, and observers agree in describing stocks of import wheat in mills as moderately low, at least lower than in 1927, practically throughout Europe. The conclusion seems reasonable in view of the smaller imports this year than last, Russian purchases of wheat in July, the tendency of millers and bakers to buy from hand to mouth on a falling market, and the prospects for a reasonably early harvest of domestic wheat crops. Yet we see no reason to suppose that import wheat stocks were abnormally low at the close of 1927–28. But Italy and Poland alone among European countries imported distinctly more heavily in June–July this year than last, and in these countries stocks of import wheat may have been somewhat increased.[3]

Reliable evidence is not available respecting stocks of native wheat in most European countries. Observers are agreed that a reduction occurred in Italy, where stocks were exceptionally high at the end of 1926–27. In Jugo-Slavia, Roumania, and Spain the crops of 1927 were too small to permit any increase, and reductions seem probable. Most observers speak of a slight reduction in France, though M. Sicot estimated that year-end stocks reached some 36 million bushels, the same as in 1927. On the other hand, reserves were apparently higher in a few countries. In Germany, stocks of winter wheat for sale on farms on June 15 were estimated by the German Agricultural Council as 9.85 million bushels in 1928 as against 4.15 million in 1927. In Hungary and Bulgaria, exceptionally large domestic utilization figures for 1927–28 suggest that an increase in stocks may have occurred. Some observers believe that stocks were increased in Poland, because farmers held their wheat in anticipation of a poor crop;[4] and this view is not inconsistent with data showing that apparent domestic utilization in 1927–28 was nearly 14 per cent higher than in 1926–27, when the figure was higher than in any other post-war year. Part of this heavy increase over 1926–27 is to be accounted for by increasing per capita consumption and part by a greater quantity of low-quality wheat fed to animals; but some of it may well have gone to increase stocks. Information is too scanty for other countries of Europe ex-Russia to warrant confident inferences; but there seems no reason to suppose that significant changes in stocks occurred. All told, reserves in Europe ex-Russia were presumably normal at the end of 1927–28, but perhaps somewhat smaller than at the end of 1926–27.

Most reports speak of a reduction of stocks in Russia during 1927–28. Official estimates suggest that stocks had been considerably built up in the course of the preceding year. Mr. N. Dubenietzky presents figures (apparently official) showing that stocks of all grains increased from 87.8 million quintals at the beginning of 1926–27 to 138.2 million at the beginning of 1927–28.[5] One may reasonably infer that wheat stocks were increased along with

[1] See Appendix Table XXV.

[2] The figures for the past five years are as follows, in thousand bushels: 1924—1,630; 1925—1,321; 1926—536; 1927—1,436; 1928—1,613.

[3] The *Polish Economist* of October 1928, p. 390, mentions the "existence of large stocks owing to excessive imports . . . ."

[4] *Polish Business Conditions,* July 1928, I, 57.

[5] *Statistical Review,* February 1928, p. 25.

other grains; but the extent of the increase in wheat alone is of course uncertain. That wheat stocks were reduced in the course of 1927–28 is probable in view of the smaller crop and of purchases of wheat for import in July 1928, though some of this wheat may have been imported for seed. On the other hand, reports that peasants parted with their grain reluctantly, on account of a great disparity between the prices obtained and the prices of manufactured articles, have been current during 1927–28 as well as in preceding years. If this factor was of real importance, a further increase of stocks in peasant hands during 1927–28 may conceivably have occurred. But since Russian officials have mentioned a lack of grain stocks at the beginning of the 1928 harvest, and the need for accumulation in 1928–29,[1] a reduction during 1927–28 seems on the whole somewhat more probable than an increase.

IV. WHEAT PRICE MOVEMENTS

The Level of Prices

The general level of international wheat prices in 1927–28 was lower than in 1926–27, and lower indeed than in any other postwar year except 1922–23 and 1923–24. As one simple indicator we cite below the annual weighted average prices per bushel of all wheat imported into the United Kingdom, as derived from customs declarations:

1922–23	$1.38	1925–26	$1.70
1923–24	1.22	1926–27	1.64
1924–25	1.77	1927–28	1.55

Essentially the same fact is evident from Chart 7, which presents three-week moving averages of British parcels prices, of No. 3 Northern Manitoba at Winnipeg, and of cash sales of all classes and grades of wheat in the principal markets of the United States. The world crops (ex-Russia) of 1927 were somewhat larger in size than those of 1923, but in the interval the world demand for wheat increased. Broadly speaking, the level of prices in 1927–28 was much higher than that of 1923–24 because the margin between import requirements and export surpluses was distinctly narrower; it was somewhat lower than that of 1926–27 because the margin was slightly wider.[2]

As Chart 7 shows, spreads between average prices in Great Britain, Canada, and the United States do not remain the same from year to year. Conditions peculiar to Canada or the United States, as well as variations in the cost of transportation, affect these spreads. Consequently annual average prices in exporting countries do not show the same changes from year to year as annual average prices of British imports. For example, British parcels prices in 1927–28 were farther below those of 1925–26 than were United States prices, because in 1925–26, with a short crop, the prices of several types of wheat in the United States were enhanced by tariff protection. In countries which import a considerable proportion of their wheat requirement, moreover, changes in tariffs or in tariff effectiveness, or in the domestic wheat crops, may give rise to year-to-year changes in price levels which do not correspond to changes in the levels of British import prices. Thus the average of French domestic wheat prices was $1.45 in 1925–26 and $1.66 in 1927–28, or 21 cents higher in the later year, while British customs prices were 15 cents lower. The French domestic crop was exceptionally large in 1925–26, only small imports were necessary, and the tariff was lower and less effective.

Other examples could be cited with respect both to exporting and to importing countries; but these are sufficient to show that much caution must be used in speaking of year-to-year changes in the level of "world" wheat prices. The fact that British consumers pay less for wheat and presumably bread in one year than another does not necessarily imply that French, Italian, American, or Chinese consumers pay less. There is always a range of wheat prices throughout the world, and movements of prices are not always in the same direction in different countries. As a general rule,

[1] Statement of Trade Commissioner Mikojan, reported in the *Corn Trade News*, September 25, 1928.

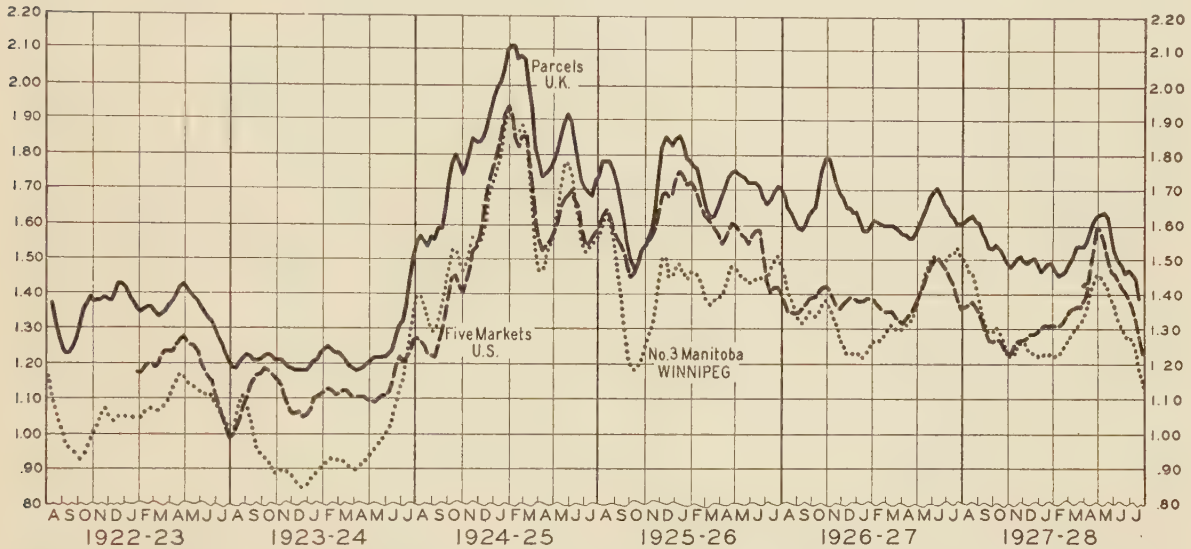
[2] See above, pp. 53 f.

in exporting countries whose exportable surpluses form a large proportion of the crop—Argentina, Australia, Canada—price movements conform more closely to the international price movement than is true in importing countries or in countries where exportable surpluses form a relatively small proportion of the crop, as in the United States, India, and the Danube countries.

dormant, little can be ascertained of their progress, and spring-wheat crops are not sown. Hence at this time new-crop prospects as a rule exert their minimum influence, and the actual rather than the prospective statistical position is effective in price making. If, then, changes in the level of international wheat prices are to be accounted for principally by reference to harvested crops and their positions, the

CHART 7.—WEEKLY AVERAGE CASH WHEAT PRICES IN THE UNITED KINGDOM, THE UNITED STATES, AND CANADA, FROM AUGUST 1922*

(*U.S. dollars per bushel; 3-week moving average*)



* United Kingdom prices are averages of sales of wheat parcels in British markets, from *London Grain, Seed, and Oil Reporter;* United States prices are weighted averages of all classes and grades of wheat in five markets (six markets after December 1926) from *Crops and Markets;* Canadian prices are weekly average cash closing prices of No. 3 Northern Manitoba at Winnipeg.

To explain changes in the level of international wheat prices is a complex process. Prices in a given year are affected not only by the available supplies and the demand situation in that year, but also by prospective changes. There is only a short period in the middle of the crop year when the supply situation remains practically stable and is reasonably well known to traders. In January–March the outcome of all the crops available for use in a given crop year is fairly certain, as is not true of the important Canadian and European crops in August–September, or of the Argentine and Australian crops in October–November, often in December. In this period, moreover, the Northern Hemisphere winter-wheat crops for the next harvest are

price levels considered might well be the mid-winter levels rather than the levels of the year as a whole.

The following figures show January–March average prices per bushel of all wheat imported into the United Kingdom, in comparison with the annual averages of the same data as given above.

Year	Jan.–March	Aug.–July	Year	Jan.–March	Aug.–July
1922–23	$1.40	$1.38	1925–26.....	$1.75	$1.70
1923–24	1.20	1.22	1926–27.....	1.62	1.64
1924–25	2.00	1.77	1927–28.....	1.49	1.55

In 1926–27, international wheat prices advanced and receded sharply in September–December because of a bulge in ocean

freight rates; and another advance and recession occurred on account of delayed seeding of the 1927 spring-wheat crop in North America. These bulges, which were in no way due to a change in the quantity of wheat actually available in 1926–27, raised the annual average import price above what it would have been if only the actual statistical position for the year had been effective. In 1927–28 also prices were fortuitously raised in the spring of 1928 on account of poor prospects for United States and European winter-wheat crops; the annual average price was some 6 cents above the January–March average price. As measured by annual average British customs prices, the international wheat price level in 1927–28 was 33 cents above that of 1923–24, 22 cents below that of 1924–25, and 9 cents below that of 1926–27. As judged by January–March prices, the level of 1927–28 was only 29 cents above that of 1923–24, but was 51 cents below that of 1924–25,[1] and 13 cents below that of 1926–27. The latter method thus leads to the conclusion that 1927–28 was a year in which the characteristic level of wheat prices was lower relative to the characteristic levels of earlier years than appears from a comparison based on average annual prices.

A broad view of differences in average annual prices between 1926–27 and 1927–28 is given by the following figures, in cents per bushel:

	1926–27	1927–28	Decrease
British (customs)	164	155	– 9
United States (farm)..	123	120	– 3
Canadian (farm)	109	100	– 9
Argentine (Barletta)..	144	137	– 7
Australian (f.o.b.)	137	134	– 3
British (domestic) ...	157	137	–20
French (domestic) ...	182	166	–16
German (domestic) ..	177	162	–15
Italian (domestic)	208	192	–16

[1] The January–March price level of 1924–25—months in which the peak of prices was reached—is presumably too high properly to be regarded as the level representing the balance between actual supplies and demand in that year, though on the other hand the August–July level is too low. See WHEAT STUDIES, November 1925, II, 36–41. A difference of 51 cents in 1924–25 and 1927–28 prices overstates the difference in the international statistical positions of the two years, though a difference of 22 cents understates it.

[2] See Appendix Table XXII.

[3] The annual average prices of No. 3 Northern Manitoba at Winnipeg declined only 5 cents, from $1.35 to $1.30 per bushel.

The decrease in wheat prices in exporting countries was (except in Canada) smaller than the decrease in international prices. Ocean freight rates on most routes were considerably lower in 1927–28 than in 1926–27, or indeed than in any recent year;[2] and since changes in transportation charges tend initially to affect c.i.f. prices more than f.o.b. prices, the smaller decreases in export than in import prices may be partially accounted for by the lower level of ocean rates. In the United States, however, other factors were operative: the crop of soft red winter wheat was short in 1927–28, and high premiums for this variety tended to raise the average price on the total crop; premiums for protein ran exceptionally high; and the advance of prices in the spring of 1928 was more extreme than in other exporting countries. Presumably the poorer quality of the 1927 crop tended to lower the average price of the Canadian crop below that of 1926; crops of identical quality might not have differed so much as 9 cents per bushel in price.[3] The decline in Australian prices might have been more than 3 cents had not the Australian crop of 1926 been distinctly large, that of 1927 distinctly small.

The prices of domestic wheat in important European importing countries decreased more between the two years than did international wheat prices. In Germany, the United Kingdom, Poland, and France, the 1927 crops of native wheat were larger than those of 1926, and poorer in quality as well. Italy had a smaller crop; but the decline in prices is perhaps to be attributed to the fact that large stocks were carried out of 1926–27, and swelled the supplies available in 1927–28. The decline in French prices would doubtless have been greater had not the tariff been raised from 25 to 35 francs per quintal on November 19, 1927.

THE GENERAL COURSE OF PRICES

From week to week and from month to month within a given year, wheat prices do not move in precisely the same direction or to precisely the same extent between any two markets, because the influences affecting prices differ in different countries. Prices in the leading export-

ing countries, however, tend to move fairly closely with international prices, except at times when changes in transportation costs (as in the autumn of 1926) disturb the relationships. When fluctuations are wide, similarities in movements are naturally more striking than when fluctuations are narrow. Prices in European countries seldom follow the international price movement so closely as do prices in the leading exporting countries.

As judged by the prices of import wheats or wheat futures in the United Kingdom or by cash and futures prices in the four leading exporting countries, four major price movements occurred during August–July 1927–28. From August until the end of October a considerable decline took place in all these markets; comparative stability prevailed from early November to early February with prices moving upward in some countries and downward in others; from early February to the end of April the course was distinctly upward, especially in April; and during May–July a drastic decline occurred. Chart 7 (p. 69) shows the movement of cash prices in the United Kingdom, the United States, and Canada; Chart 8 (p. 72) shows the movement of futures prices in Liverpool, Chicago, Winnipeg, and Buenos Aires. Monthly average cash wheat prices in Argentina and Australia appear in Appendix Table XXVIII.

The decline of August–October 1927 was due chiefly to improving crop prospects in Canada. A sharp rise of prices—7 cents in Winnipeg, 4½ cents in Liverpool—occurred on August 8–9, following a frost in Canada on the night of August 7. For a week or more thereafter the futures markets were nervous. In response on the one hand to conflicting reports on the extent of frost damage, the progress of rust infestation, and wet harvesting weather in Europe, and on the other hand to profit-taking, futures prices moved erratically but did not depart far from the level established on August 8–9. The definite downward trend began on August 18, on reports of good weather in Canada and private estimates of a large crop despite the frost. Subsequently every day of fair weather in Canada occasioned further recessions. Especially sharp declines were recorded following the appearance of the American and Canadian crop estimates on September 9 and 13, both of which were regarded as bearish; and exceptionally heavy marketings in both Canada and the United States, together with favorable crop news from the Southern Hemisphere, combined to force a further sharp recession in the middle of October.

From November to early February, comparative stability prevailed; but price movements were different in different markets. Canadian cash prices of the higher grades moved irregularly; they rose in November as evidence of poor quality became increasingly clear, but declined in December and thereafter remained stable. Chicago futures prices tended upward throughout the period, but not so rapidly as weighted average cash prices in the United States, which were influenced strongly by increasing premiums on soft red winter wheat (see Chart 10, p. 75). In Australia, Argentina, and the United Kingdom, the trend of cash prices was moderately but clearly downward as the Southern Hemisphere crops were secured and marketed. During this period, with visible supplies running exceptionally high and the uncertainties of the supply situation largely eliminated, importers pursued a policy of leisurely but not niggardly purchasing, which proved sufficiently active to prevent large recessions in prices as the Argentine crop was pressed on the market. Speculative activity in the United States—and presumably elsewhere—was at a low level, the lowest of any period after 1921 except December–February 1924.[1]

From early February 1928 until the last of April, new-crop prospects dominated the price movement and gave rise to a sharp upturn, most extreme in the United States. The crop outlook naturally exerted its influence more strongly as spring approached —more strongly in April than in March, in March than in February. May futures prices rose 41 cents in Chicago, 24 cents in Winnipeg, 18 cents in Liverpool, and 16 cents in Buenos Aires; cash prices were similarly affected. The principal cause of the advance was the increasingly unfavorable

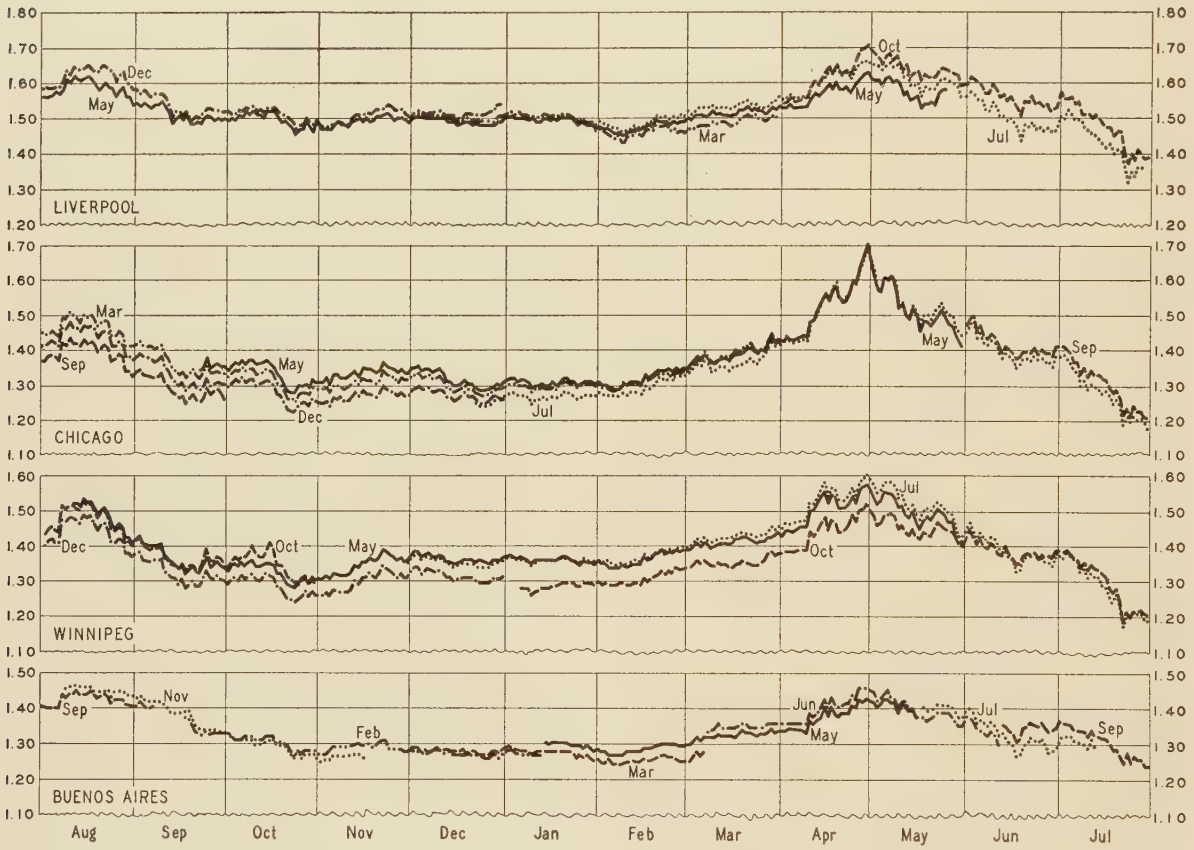
[1] See Appendix Table XXX.

outlook for winter-wheat crops, chiefly in the United States east of the Mississippi, but also in western and central Europe. Partly because of the new-crop outlook, partly because stocks of import wheat had become depleted by restrained buying on a falling market, European purchasing became active in early February. Rumors—officially denied the next day—that Russia was on an import basis were circulated on February 16, and tended to strengthen prices. In the United States milling demand for cash wheat strengthened perceptibly as milling activity increased from the abnormally low seasonal levels of the winter months.[1] Speculative activity in the United States became increasingly pronounced. On the upward movement, the spreads between Chicago and Liverpool, Chicago and Winnipeg, and Winnipeg and Liverpool futures were gradually reduced. On April 30 the Chicago July future stood 4 cents above the Liverpool instead of 21 cents below, as had been the case three months before; and Winnipeg stood only 6 cents below Liverpool as against 13 cents below on February 3. Traders outside of the United States saw little reason to follow the Chicago advance to its full extent, especially in the face of the huge visible. The narrowing of the Winnipeg - Liverpool spread was remarkable while so large a visible existed.

The last three months of the crop year witnessed one of the most extreme recessions in wheat prices recorded since the crash of prices in 1920–21. From the peak of $1.69 per bushel on April 30, the July

Chart 8.—Daily Closing Prices of Principal Wheat Futures in Four Leading Markets, August–July 1927–28*

(*U.S. dollars per bushel*)



* Data from *Chicago Journal of Commerce* and *Daily Trade Bulletin*, Chicago.

[1] See below, p. 86.

future at Chicago fell to a low point of $1.17 on July 31, a decline of 52 cents in three months. The recession was naturally more drastic in Chicago than elsewhere, since Chicago prices had moved far out of line in the earlier advance. This extensive decline began on May 1, when unofficial forecasts of American winter-wheat crops ran higher than had generally been expected. Profit-taking by "longs" probably was influential. The official report of condition and abandonment, issued May 9, occasioned a sharp decline on the following day; unfavorable though it was, it was less so than had been expected. Subsequently rains visited the droughty Southwest, and further declines occurred as prospects there improved. Reports of dry weather in the spring-wheat belt supported the market during the second half of May; but improving prospects of spring wheat, both in the United States and Canada, were the principal cause of the weakness of prices in the first half of June, though the heavy visible supplies also began to exert pressure. The decline was temporarily checked in late June and early July by frequent rains hampering the winter-wheat harvest in the United States, and by reports of Russian wheat purchases. But excellent crop prospects both in the North American spring-wheat belt and in Europe, hedging pressure, and the weight of visible supplies combined to force a precipitous decline throughout the remainder of the crop year under review.

On the decline, the narrow spread between both Winnipeg and Liverpool and Chicago and Liverpool futures prices widened steadily; but that between Chicago and Winnipeg did not. With improving crop prospects, the Canadian visible assumed an increasingly bearish aspect. Acute competition for export business arose between Canada, the United States, and Argentina. Whereas in March–April, Chicago led in the upward movement of prices and Winnipeg followed with reserve, no reserve was shown by either market in the decline of May–July; and Argentine prices had consistently remained low. Canadian wheats during most of the period could be purchased c.i.f. Europe at lower prices than comparable American wheats; and No. 3 Manitoba became cheaper even than Argentine Rosafé wheat at Liverpool in June and July.[1] As a result of these price relationships, themselves due to changing crop prospects and the large supplies of Canada, Canadian exports were unusually heavy in June and July,[2] whereas but little United States wheat was exported. The export business went to Canada and Argentina, where stocks were worked down; but with the new American crop flowing to market, the United States visible rose higher and by July 31 reached heights unprecedented for the season.

The evidence suggests that Canadian wheat was pressed for sale in June–July. If much of it was owned by the Pool, the Pool must have pressed its offers; and if this pressure contributed to the decline of prices, the Pool appears to be partially responsible for the general decline. But it was perhaps in some part responsible, if it then tended to restrict sales, for the advance of February–April, and the net effect of Pool policy on wheat prices remains uncertain in 1927–28 as in preceding years.

An extended analysis of wheat price movements in various European countries is beyond the scope of this review. Chart 9 (p. 74) is pertinent, however, to illustrate the extent to which prices of native wheat in Italy, France, Germany, Poland, Hungary, and England have moved at variance with international wheat prices (British parcels) in the course of the past two years. German prices alone show a marked tendency to fluctuate with international prices; and even here the tendency was little in evidence in 1926–27. French prices in 1927–28 would have conformed more closely to the international movement if the increase in the tariff had not caused a sharp rise between October and November, whilst international prices were declining slightly. In most of these countries prices tend to be low in relation to international prices directly after harvest, and high immediately before harvest; there is apparently a marked seasonal movement, so strong as practically to obscure the tendency toward coincidence of international and domestic

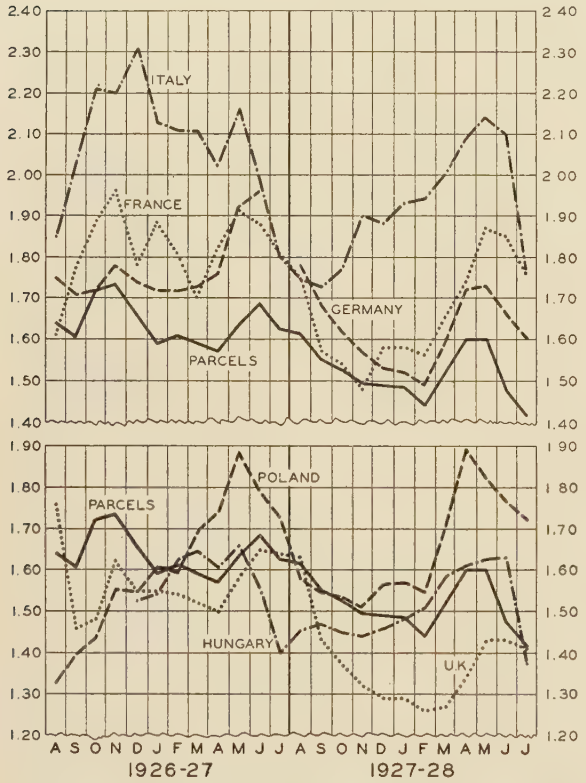
[1] See Appendix Table XXVII.

[2] See below, p. 83.

price movements. The subject requires further investigation; but one may reasonably suppose that the comparative lack of facilities for hedging and of terminal storage space is one cause of the common sharp post-harvest declines.

CHART 9.—MONTHLY PRICES OF DOMESTIC WHEAT IN EUROPE, COMPARED WITH BRITISH PARCELS PRICES, FROM AUGUST 1926*

(*U.S. dollars per bushel*)



* For sources of Italian, French, German, and United Kingdom domestic prices, see Appendix Table XXVIII. British parcels prices are from *London Grain, Seed, and Oil Reporter;* Polish prices from *Wiadomosci Statystyczne;* Hungarian prices from *Magyarorszag.*

RELATIONSHIPS OF NEAR AND DISTANT FUTURES

Certain features of the relationships of near and distant futures in the leading markets during 1927–28 are of interest. Most striking were the considerable and unusual discounts of the May future under the July and the July under the October in Liverpool in the last four months of the year. This was largely the result of abnormally high visible supplies toward the close of the crop year. At Chicago the July and September futures ordinarily run at substantial discounts under the May, but in 1927–28, after December 1927, these discounts were small. Unfavorable prospects for new crops maintained the prices of July and September futures relative to the May, and high visible supplies tended to depress the May relative to the July and September. The September future seldom commands a premium over the July, but such was the case in the last two months of 1927–28. In Winnipeg, the spread between the October (new-crop) and the May and July (old-crop) futures was narrower than usual; and in June–July, the October sold above the July. This situation presumably could not have occurred unless the existence of large stocks had justified a carrying charge between the two futures. In the preceding two years the July future commanded premiums of more than 10 cents over the October; and this relationship appears to be normal. The whole subject of normal or customary spreads between near and distant futures requires further analysis; nevertheless, the characteristic relationships now appear to have been disturbed toward the close of 1927–28 by the exceptionally high level of visible wheat supplies.

Another unusual fact was that futures prices in Winnipeg during the closing months of the several futures (October, December, May, and July) failed to approximate at all closely the cash prices of No. 1 Northern Manitoba, the only grade of Canadian wheat deliverable without discount on futures contracts. The spreads between cash prices of Nos. 1, 2, and 3 Northern were abnormally wide in 1927–28 because the two upper grades were very scarce while No. 3 was plentiful. These spreads may be illustrated by the following average cash prices in May of the past five years:

Year	No. 1 Northern	No. 3 Northern	Spread
1924	$1.04	$0.98	$0.06
1925	1.82	1.74	0.08
1926	1.53	1.44	0.09
1927	1.56	1.46	0.10
1928	1.57	1.42	0.15

With No. 3 wheat deliverable on futures contracts at a discount of only 8 cents, it is

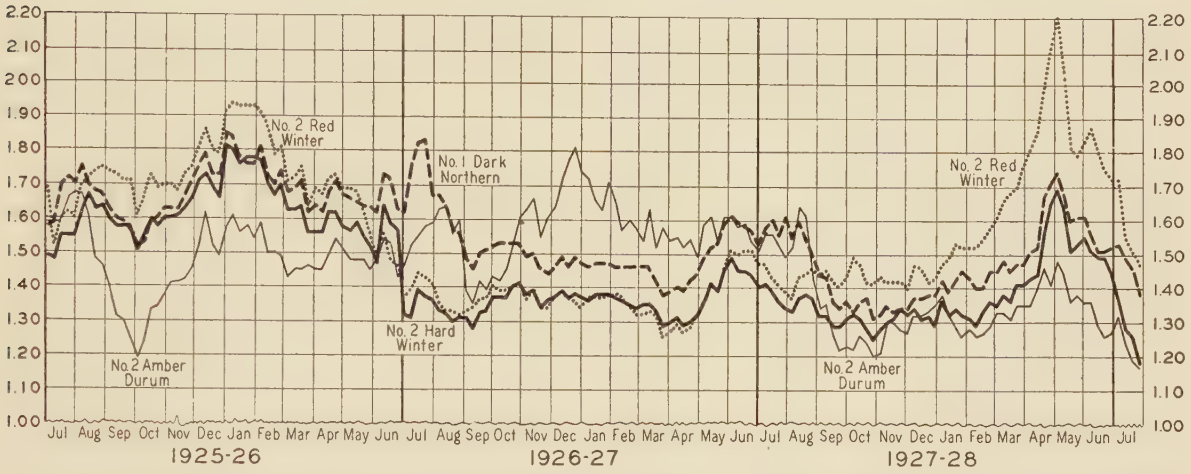
not surprising that futures prices throughout the year ran distinctly lower than cash prices of No. 1 wheat, and for the first time in five years they were at or below the cash prices of No. 2 wheat in all four of the futures closing months.

United States Cash Prices

Cash prices of the several varieties of wheat in the United States vary from year to year in accord with special circumstances affecting the particular varieties. Chart 10 shows weekly weighted averages of four different grades and types of wheat for the past three years. Early in the crop year, while prices of No. 2 Red and No. 2 Hard Winter wheat were falling as the crops were secured, the prices of the spring wheats, No. 1 Dark Northern and No. 2 Amber Durum, remained high. This general relationship usually occurs, but in 1927–28 spring-wheat prices were perhaps exceptionally high on account of unusual possibilities of damage from rust and frost.

Chart 10.—Weekly Average Cash Prices of Typical Wheats in United States Markets, from July 1925*

(*U.S. dollars per bushel*)



* No. 2 Red Winter at St. Louis, No. 2 Hard Winter at Kansas City, No. 1 Dark Northern Spring and No. 2 Amber Durum at Minneapolis. Data from *Crops and Markets*.

The outstanding feature of cash price relationships was the considerable premium on soft red winter wheat, a result of the short crop. The fact that winterkilling of the 1928 crop was heaviest in the soft red winter-wheat area caused this premium to increase markedly in January–April; and by the first of May, No. 2 Red Winter sold for over 45 cents per bushel more than No. 1 Dark Northern, the dearest of the other three wheats whose prices appear on the chart. The peak of soft red winter prices in early May, $2.20 per bushel, was the highest recorded since the great decline of wheat prices in 1920. Despite American predilection for strong flour, soft red winter wheat readily rises to a premium position under shortage.

No. 2 Amber Durum wheat was the discount wheat in 1927–28. The domestic crop was much larger than in 1926–27, when durum commanded a premium; and Canada and North Africa also secured larger crops. The discount on durum in 1927–28 was not as heavy as in 1925–26; but in the earlier year the prices of other varieties of wheat were enhanced not only by short crops but by tariff protection. The United States crop of durum, of which the bulk always goes for export, does not benefit from tariff protection as other varieties may do under appropriate circumstances.

The larger size of the hard red spring-wheat crop and the smaller size of the hard red winter-wheat crop resulted in a smaller spread in 1927–28 between the prices of No. 1 Dark Northern and No. 2 Hard Winter than prevailed in 1926–27.

Extraordinarily high premiums for protein content in hard spring and hard winter

wheat were also an outstanding feature of the cash price situation in 1927–28. Data are not available to show precisely how great were the spreads in price within particular grades due to differences in protein content alone. There can be little question, however, that for the year as a whole premiums on protein ruled higher than ever before—not necessarily because the crop was the lowest in average protein content, but in part because the purchase of wheat on protein analysis has grown rapidly in favor in recent years. During a good part of 1927–28 millers paid as high as 10 cents per bushel premium for each additional per cent of protein over 11 per cent. Such high premiums were the more striking in view of the margin of error in sampling and in the chemical determination of protein content, and in view of the effect of other factors upon milling quality.

The spreads between roughly comparable grades of American and Canadian wheats, No. 1 Dark Northern at Minneapolis and No. 3 Manitoba at Winnipeg,[1] were, as in 1926–27, too small to permit profitable importation of Canadian wheat into the United States over the tariff wall of 42 cents per bushel. The spread in favor of Minneapolis was only 5 cents per bushel at the beginning of the crop year. But by July 1928 the spread had increased to 27 cents as Canadian prices were reduced more than American under the pressure of high visible supplies. This was the widest spread of the year; at no time did the discrepancy become so great as that prevailing in most of 1925–26, when duty-paid importation at times became feasible.

Returns to Wheat Growers

Comparisons of the profitableness of of wheat production are always difficult. Data are not available to permit an extensive and accurate tabulation showing for many countries weighted annual average prices in relation to crops produced and to gross costs of production. For the leading wheat producers, however, sufficient information is available to justify discussion.

Table 9 shows approximate crop values for the past five years in several important wheat-producing countries, as calculated from annual average prices and crop production. The year 1923–24 stands out among the five as one of distinctly low crop values —so low, indeed, that despite deficiencies in the data, that year may safely be regarded as distinctly the least profitable to wheat growers generally. It was followed by reduced acreage in the United States and western Europe, though apparently not in most other important producing regions (see Chart 2, p. 51). Crop values were much higher in all four of the following years, but close comparisons of the relative profitableness of wheat production in these years must remain uncertain on account of shortcomings in the data.

Table 9.—Approximate Value of Wheat Crops in Selected Wheat-Producing Countries, 1923–24 to 1927–28*

(Million dollars)

Country	1923–24	1924–25	1925–26	1926–27	1927–28
United States	734	1,106	1,022[a]	1,076[a]	1,054
Canada	318	342[a]	529[a]	452[a]	480[a]
Argentina	263	317	317	318	370[a]
Australia	128	237	169	220	147
France	372	486	480	422	458
Italy	270	316	501	459	376
Germany	111	139	190	169	195
British Isles	71	86	85	82	78

* Calculated from official crop estimates (sometimes corrected) multiplied by annual average prices as follows: U.S., weighted average farm price; Canada, official average farm price; other countries, unweighted averages of monthly average terminal prices at Buenos Aires, Melbourne, Chartres, Milan, and Berlin, and of *British Gazette* prices. See Appendix Tables III, XXVII, XXVIII, XXXI.

[a] Using official crop estimate adjusted according to our estimates of error.

In the first place, the crop values shown in Table 9 do not represent accurately the gross returns of farmers from wheat. Weighted average prices and sales from the farm are required for this purpose, but are not available. In the second place, gross returns from sales would not necessarily indicate the profitableness of wheat growing; one would need also to consider wheat used on farms, production costs, and changes in the wheat-growing population. Information is not available on most of these subjects.

Nevertheless, if, as seems reasonable to suppose, operative costs of production per acre (rent of land excluded and yield dis-

[1] See Appendix Table XXVII.

regarded) have not changed materially in most countries, the year 1927–28 would seem to have been distinctly unprofitable only in Australia and the British Isles. Australian producers suffered from the disadvantages of high acreage with increased gross production costs, a short crop, and only moderate prices; unless operative costs have declined considerably in the interval, 1927–28 may have been as unsatisfactory a year as 1923–24. In the British Isles so much of the crop of 1927 was unmillable that the crop value and the net return to farmers may have been lower even than in 1923–24.

The higher crop values in Germany and France in 1927–28 than in 1926–27 may be partially fictitious, since so much wheat was unfit for milling. The Italian situation is confused by the fact that a good deal of the wheat crop of 1926 was held over and marketed in 1927–28, so that returns to farmers in 1927–28 were perhaps not so much smaller than in 1926–27 as the figures suggest; but in any event returns were presumably higher than in 1923–24 and 1924–25, though lower than in 1925–26. Producers in Argentina appear to have enjoyed a distinctly remunerative year in 1927–28; though high acreage increased gross costs, net returns were probably high because of the record crop. Canadian producers also seem to have enjoyed a remunerative year, somewhat the best of the period except 1925–26, despite a crop of poor average quality. The Canadian acreage was not extraordinarily large, while yield per acre was unusually high.

So far as can be judged by crop values in the United States, which must be calculated by the use of adjusted official crop estimates for 1925 and 1926, the year 1927–28 differed comparatively little from the three preceding, but was distinctly more profitable than 1923–24. The areas both sown and harvested[1] were considerably larger than in 1924–26, however, so that gross costs were relatively high, unless increased use of the combine and other factors caused a compensating reduction.[2] In view of the fact that farmers on August 1, 1928, expressed intentions of planting an area to winter wheat 6 per cent smaller than they intended to plant on August 1, 1927, and 2.1 per cent smaller than they actually planted for the crop of 1927, the year 1927–28 as a whole may have appeared unremunerative. But intentions to plant were announced at a time when prices were lower than at any time during the preceding crop year; and this price situation rather than returns from the crop of 1927 may have influenced farmers' decisions.

Within the United States, the situation differed in different areas. Weighted average terminal prices of several grades of representative wheats appear in Table 10,

TABLE 10.—ANNUAL WEIGHTED AVERAGE WHEAT PRICES IN THE UNITED STATES, 1920–28*

(Dollars per bushel)

Crop year July–June	Farm price	No. 2 Red St. Louis	No. 2 Hard Kansas City	No. 1 Dark Northern Minneapolis	No. 2 Amber Durum Minneapolis
1920–21....	1.83	2.13	1.83	2.01	2.00
1921–22....	1.04	1.27	1.20	1.48	1.19
1922–23....	.98	1.21	1.13	1.26	1.07
1923–34....	.92	1.07	1.05	1.24	1.06
1924–25....	1.28	1.59	1.35	1.58	1.56
1925–26....	1.46	1.69	1.63	1.65	1.44
1926–27....	1.23	1.38	1.35	1.51	1.55
1927–28....	1.20[a]	1.49	1.35	1.41	1.32
Average 1909–14....	.89	1.00	.95	.99[b]	.89[c]

* Data of U.S. Department of Agriculture.

[a] Preliminary.

[b] No. 1 Northern, which commonly sells from 3 to 5 per cent under No. 1 Dark Northern. The latter was not quoted prior to August 1, 1917.

[c] No. 2 Durum.

and wheat production by classes is shown in Appendix Table IX. Growers of hard red spring wheat appear to have enjoyed a distinctly good year in 1927–28, perhaps the best in the past seven years except 1924–25, for the crop was of record size while prices were not too low to counterbalance this advantage. Durum wheat growers also enjoyed a relatively good year, better even than 1924–25 because the crop was so much larger. Growers of hard red winter prospered less than in either 1924–25 or 1926–27. Growers of soft red winter

[1] See Appendix Table VI.

[2] Net costs per acre excluding land rent, according to official data, show no definite trend over the past five years, but in 1927–28 were slightly the lowest in the past five years. See June issues of *Crops and Markets*.

suffered most; the crop was so small that in spite of fairly good prices per bushel the gross returns were the smallest in post-war years. Growers in the Pacific Northwest, with a distinctly large crop, presumably enjoyed relatively good returns.

V. INTERNATIONAL TRADE IN WHEAT AND FLOUR

The movement of wheat and flour in international trade in the year under review provided fewer surprises and striking features than was true in 1926–27. With crops and their distribution fairly well known early in the year and fairly stable prices and freight rates in prospect, most observers expected the volume of trade to prove distinctly large, though not of record size; and such was the event. The course of trade suffered no such disturbance as occurred in 1926–27. The outstanding features of the international trade in 1927–28 were the enormous exports from North America (especially the Pacific Northwest) and Argentina, the heavy imports of central European countries, and in the latter months of the year the heavy movement from Canada. But events in particular countries, often of little effect on the general volume or course of international trade, were of interest and of some significance. Trade in wheat flour is discussed below, in Section VI.

Volume and Course of Trade

As measured by the sum of net exports from net exporting countries, the volume of international trade in 1927–28 reached some 818 million bushels, about 28 million smaller than in the preceding year, but the second (or third) largest movement in history. Overseas shipments (Broomhall's data) were smaller, 793 million bushels; these data show a decline of some 21 million bushels from the record figure of 1926–27. For the past six years, net exports compare with overseas shipments as follows, in million bushels:

Year August–July	Net exports[a]	Broomhall's shipments[b]
1922–23	711	676
1923–24	824	775
1924–25	767	715
1925–26	693	668
1926–27	846	814
1927–28	818	793

[a] See Appendix Table XVII. Partially estimated, especially with reference to Russian exports.
[b] See Appendix Table XVI.

Discrepancies between the two sets of figures arise from several causes which need not here be discussed;[1] that trade was of distinctly large volume in 1927–28 is clear. If one accepts net exports as the more accurate measure, trade in 1927–28 was of much the same volume as in 1923–24. The principal difference between these two years lies in the fact that in 1927–28 exports to ex-European destinations were much smaller—by over 30 million bushels—than in 1923–24, while exports to European destinations were correspondingly larger.[2]

The decline in the total volume of trade between 1926–27 and 1927–28 was due principally to the fact that Europe harvested wheat crops some 60 million bushels larger in 1927 than in 1926, and hence needed to import less wheat. The volume of trade in 1927–28 might have proved smaller except for the considerable quantities of unmillable wheat in the European crop, the upward trend in both European and ex-European wheat consumption, the larger supplies in exporting countries, and the lower level of international wheat prices.

The course of trade presents several features of interest. Broomhall's shipments data, which represent the actual week-to-week movement overseas better than net export data,[3] are summarized in the form of three-week moving averages of weekly data in Chart 11. In 1927–28 the August–September movement was exceptionally heavy, largely because European crops were late and supplies of foreign wheat were needed. As usual, shipments declined in December with the closing of lake

[1] See Wheat Studies, November 1927, IV, 10 f., and August 1928, IV, 340.

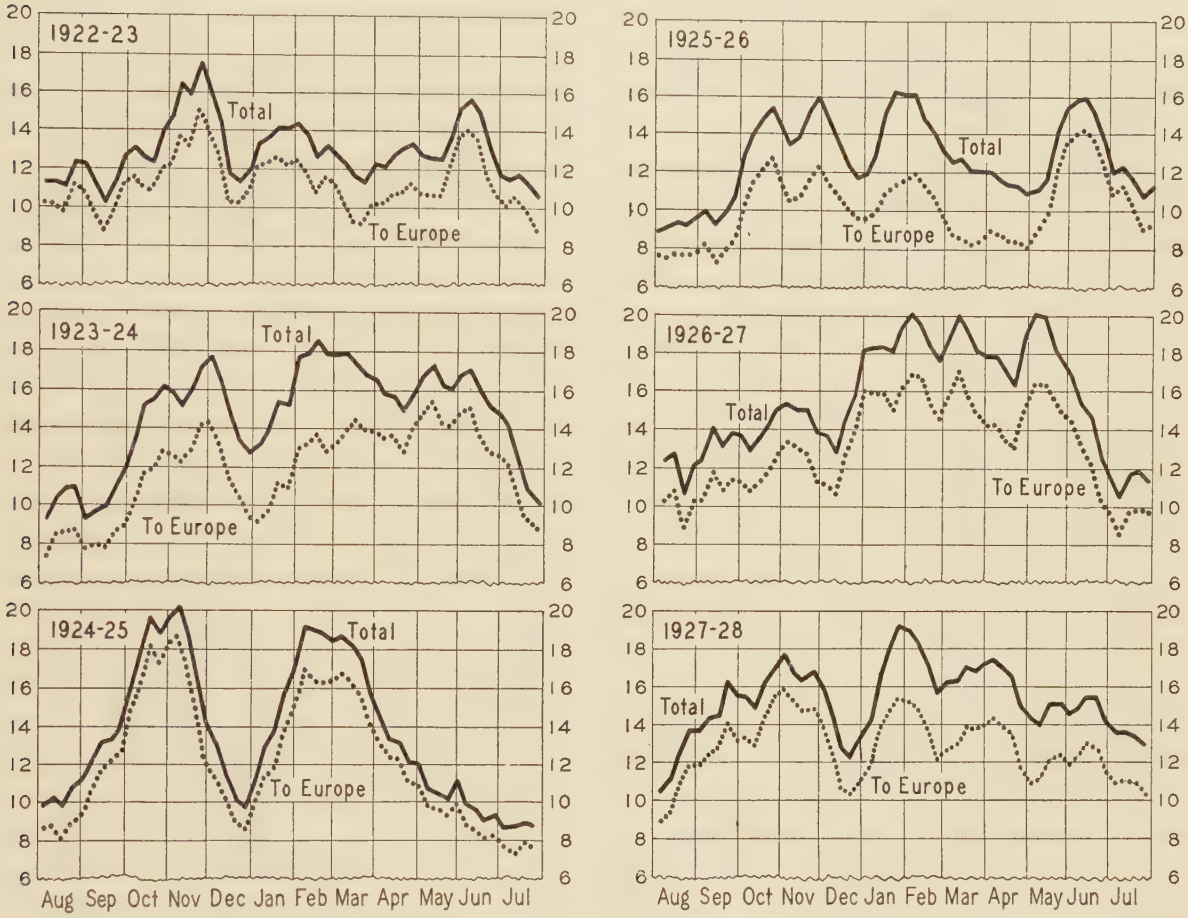
[2] See below, p. 80.

[3] Net export data are available only in monthly figures. Moreover, Canada sends large quantities of wheat into the United States in September–November; but some of this wheat, which appears as net exports from Canada, does not pass overseas within the period, but is shipped in the winter months when navigation on the Great Lakes is closed. Hence monthly net export statistics exaggerate the autumn overseas movement at the expense of the winter movement.

navigation; and the customary peak was reached in late January with the free movement of newly harvested wheat from Argentina and Australia. No conspicuous peak occurred, however, in May or June, as is usual with the opening of lake navigation in years when Canada has large stocks. European importers appear to have restricted their purchases with sharply rising prices in April and declining prices in May, but resumed their buying in June and July as the decline progressed and Canadian offers became more pressing. As a result, the flow of wheat to export declined less in May–July 1928 than in any of the past six years. All told, the international movement was more evenly distributed than usual. The contrast with 1926–27 is noteworthy: in that year exports were restricted in the first half of the year by a bulge in ocean freight rates, and were swelled in the second half when freight rates declined and importers made up their arrears.

CHART 11.—INTERNATIONAL SHIPMENTS OF WHEAT AND FLOUR, WEEKLY FROM AUGUST 1922*

(Million bushels; 3-week moving average)



* Broomhall's data, from the *Corn Trade News*.

IMPORTS AND THEIR DISTRIBUTION

In the absence of statistics for many countries, especially the ex-European, an entirely satisfactory analysis of net imports of wheat and flour by crop years cannot be obtained; nor is it possible to employ statistics of exports by destination, since "orders" shipments confuse the picture. A rough allocation of net exports to Europe and to ex-Europe is made feasible by computing the sum of exports from net export-

ing countries to ex-European destinations, and assuming that the difference between total net exports and exports to ex-Europe constituted the amount of wheat exported to Europe. This allocation is at best only approximate because total net exports are for August–July crop years, while exports to ex-Europe are for July-June years, and the ex-European figures are subject to other qualifications.[1] The figures are as follows for the past six years, in million bushels:

Crop year	Total net exports	Exports to ex-Europe	Exports to Europe
1922–23	711	98	613
1923–24	824	164	660
1924–25	767	96	671
1925–26	693	132	561
1926–27	846	126	720
1927–28	818	134	684

Among the principal ex-European importing countries—Japan, China, the West Indies, Brazil, Egypt, and South Africa—all except Egypt took a little more wheat and flour in 1927–28 than in 1926–27.[2] All told, the five principal ex-European importers took about 13 million bushels more wheat in 1927–28 than in 1926–27. The increase was most noteworthy in Brazil and South Africa, and amounted to nearly 12 million bushels. Most of the minor importers took a little more; but New Zealand, Mexico, and the Dutch East Indies reduced their takings. It is significant that Chinese and Japanese takings were increased only slightly, despite lower international wheat prices. In general, upward trends in wheat consumption and lower international prices account for the increase in ex-European trade.

Table 11 shows the net imports of most of the European importing countries during each of the past five years. The principal omissions are Greece and Portugal, for which adequate data are not available. The total of these imports, 630 million bushels, was apparently only 5 million bushels smaller in 1927–28 than in 1926–27, not some 36 million bushels smaller, as our estimates of exports to Europe suggest. But the net import statistics require qualification. To include Greek imports, if they were available, would presumably raise the figure of 1926–27 in relation to that of 1927–28, and thus increase the difference. Greece had a considerably larger wheat crop in 1927 than in 1926, and required smaller imports; moreover, changes in the tariff seem clearly to have cut down her imports of flour.[3] The French imports of 1926–27 are understated, those of 1927–28 overstated.[4] With allowance for these fac-

TABLE 11.—NET IMPORTS OF WHEAT AND FLOUR BY PRINCIPAL EUROPEAN IMPORTING COUNTRIES, AUGUST–JULY, 1923–28*

(*Million bushels*)

Importing area	1923–24	1924–25	1925–26	1926–27	1927–28
British Isles[a]	239.7	227.9	209.9	237.2	232.2
Italy	69.9	88.7	67.9	86.6	89.6
Germany	30.7	80.9	57.4	91.8	88.5
France	53.3	58.5	10.3	62.3	46.9
Belgium	40.0	39.0	39.2	39.5	41.9
Netherlands	26.7	26.8	27.2	28.5	31.0
Scandinavia[b]	27.7	22.7	18.8	19.5	26.2
Switzerland	17.1	13.9	15.6	16.3	18.4
Austria	18.1	16.0[c]	14.7[d]	16.9	16.5
Czecho-Slovakia	21.2	21.5	21.7	20.1	21.4
Poland	2.6	17.1	....[e]	8.1	8.6
Baltic States[f]	7.9	7.3	7.8	7.7	8.6
Total	554.9	620.3[c]	490.5	634.5	629.8

* See Appendix Table XVII for sources and further details.

[a] Includes Irish Free State.
[b] Norway, Sweden, Denmark.
[c] Partially estimated.
[d] July–June.
[e] Net export of 4.6 million bushels.
[f] Finland, Latvia, Esthonia.

[1] We include in this calculation only the net exports to ex-Europe from Argentina, Australia, Canada, and the United States. India and Chile also make appreciable exports to ex-Europe, but data for recent years are not available. Partly because exports from India and Chile are omitted, partly because exports from the United States to ex-Europe are understated, our tabulation understates total exports to ex-Europe and overstates total exports to Europe.

[2] Appendix Table XIX shows exports from the principal exporters to these countries.

[3] See below, p. 93.

[4] In some months of 1926–27 importers were allowed a partial refund of the duty; actual imports were not required to be reported until the wheat had passed into consumption, and an indeterminate proportion of actual imports was not immediately reported. As a result, actual imports in the latter half of 1926–27 were understated; but early in 1927–28, with the refund discontinued, the monthly net import figures included not only all wheat actually imported in the stated months, but also some wheat which had arrived in France months earlier. Hence imports in the early part of 1927–28 were overstated. At some time during the middle of 1927–28, import statistics again presumably began to reflect actual arrivals.

tors, the apparent discrepancy between the changes in estimated exports to Europe and in reported imports of Europe becomes smaller. But total net imports always tend to fall below total net exports.

As Table 11 shows, the British Isles, Germany, and France were the only European countries (Greece and possibly Austria excepted) that imported less wheat and flour in 1927–28 than in 1926–27; and only in France was the decline of appreciable size. The decline of 5 million bushels in British imports equals almost exactly the increase of the domestic crop; but since an unusual proportion of the domestic crop was apparently unmillable, smaller imports were presumably due to declining per capita consumption and/or reduction in import wheat stocks. That the increase in Italian imports was only three million bushels is somewhat surprising since the domestic crop was about 25 million bushels smaller; but stocks were drawn down in the course of the year. Germany, despite a crop 25 million bushels larger in 1927–28 than in 1926–27, imported only 3.3 million bushels less wheat. Here per capita consumption is increasing, stocks were increased in the course of the year, and the effective increase in the domestic crop was smaller than the apparent increase on account of unmillable grain. The decline in French imports (apparently 15 million bushels, but actually more) naturally occurred because the domestic crop was larger; but the imports of 1927–28 might have been smaller still had not unmillable grain bulked so large in the domestic crop. The increases in other countries may be ascribed partly to lower international wheat prices, partly to the upward trend in per capita wheat consumption made more effective by continuance of economic recovery, and partly to the general prevalence of unmillable wheat. The relative strength of these influences presumably differed in different countries.

Sources of Exports

Table 12 shows a statement of the relative contributions of the several exporting countries to the total volume of international trade for 1927–28 and the four preceding years. In some slight degree, as will be noted, this falls short of completeness and accuracy. Exports from North America and Argentina comprised nearly 85 per cent of the total, by far the largest proportion in recent years. The proportion of the whole furnished by North America was also unusually large. As usual, the exports of individual countries were determined principally by the size of their crops; but certain unusual features appeared with respect both to the movement and to the volume of exports from particular countries.

Table 12.—Net Exports of Wheat and Flour from Principal Exporting Countries, August–July, 1923–28*

(*Million bushels*)

Exporting area	1923–24	1924–25	1925–26	1926–27	1927–28
United States ...	127	256	103	199	184
Canada	346	192	324	292	332
Argentina	172	123	94	143	178
Australia	86	124	77	103	70
India	20	38	8	12	9
Danube basin[a] ..	34	25	46	45	33[b]
Russia	21[c]	...	27[c]	49[c]	...[d]
Other countries[e]	18	9	14	3[b]	12[b]
Total	824	767	693	846	818

* See Appendix Table XVII for sources and further details.

[a] Bulgaria, Hungary, Jugo-Slavia, and Roumania.

[b] Partially estimated.

[c] July–June.

[d] Exports from Russia during July–June totaled 7 million bushels; but there were imports in July, and for the August–July crop year we assume that imports equaled exports.

[e] Includes Morocco, Algeria, Tunis, Chile, Spain, and Poland, for the years in which these countries were net exporters.

Net exports from the United States during August–July (not including shipments to possessions) totaled 184 million bushels from a crop of 878 million. In 1926–27, from a crop officially estimated as 42 million bushels smaller, net exports were 199 million, though outward carryovers differed little in the two years. But in retrospect the decline in net exports is not surprising. The crop of 1926 was clearly underestimated; that of 1927 may have been slightly overestimated; and more wheat was required both for food and for feed and waste in 1927–28. These factors could not be foreseen clearly early in the crop year, and most observers anticipated heavier exportation than actually occurred.

Exports of flour and of durum and Pacific wheats—in other words, unrepresentative varieties—appear to have constituted an exceptionally large proportion of the total; but precise classification of exports is impossible. The following figures in million bushels, summarized from data of the U.S. Department of Commerce, show the gross quantities of wheat (including flour) exported from groups of customs districts for the past five years ending June 30:

Customs districts	1924	1925	1926	1927[a]	1928[a]
Canadian border and lake ports	18.3	56.0	21.3	24.6	49.0
Atlantic Coast	42.3	84.0	40.9	59.1	47.1
Gulf Coast	32.1	91.9	12.0	80.5	36.5
Mexican border	2.5	.4	1.3	7.1	6.8
Pacific Coast	64.7	28.5	32.5	47.9	67.2
Total	159.9	260.8	108.0	219.2	206.6

[a] Figures for 1927 and 1928 are preliminary with respect to accurate distribution to the several customs districts. The figures for exports across the Mexican border have not yet been published, and here signify merely exports not officially allocated to other customs districts.

In so far as these and other data[1] are a guide, exports of Pacific white and soft red wheats appear to have been the largest in the past five years, while exports of durum were decidedly large, and exports of typical hard red winter, soft red winter, and hard red spring wheats—especially soft red winter—were small. The large exports from Canadian border and lake ports consisted principally of durum, as may be judged by shipments from Duluth-Superior,[2] which are destined much more largely for export than for milling in the eastern cities of the United States.

The concentration of American exports in the first half of the crop year was distinctly peculiar. The percentages of total net exports leaving the United States in the first and second halves of the past six years are as follows:

Year July–June	July–December	January–June
1922–23	66.5	33.5
1923–24	65.2	34.8
1924–25	70.6	29.4
1925–26	53.7	46.3
1926–27	66.6	33.4
1927–28	77.4	22.6

In 1927–28, January–June net exports constituted only 22.6 per cent of the total, considerably the smallest figure of recent years. The reasons are not yet entirely clear, but several factors may be cited in explanation. In the early months marketings were heavy, but demand for wheat by domestic mills was relatively light;[3] hence more than a normal proportion of receipts was available for export. In the second half of the year, milling demand was relatively heavy, and prices of representative bread wheats were forced above export parity partly by this demand and partly by the poor outlook for the winter-wheat crop of 1928; hence exports were restricted. Toward the end of the crop year, when new-crop prospects had improved, the competition from Canadian and Argentine wheat was too keen to permit United States prices of these wheats to fall to export parity, so that restriction of exports continued. Even so, the carryover was not built up to extreme heights; the visible alone was abnormally high, and it consisted largely of durum wheat, which is presumably less subject than representative wheats to the influences mentioned above.

Canada, with apparently the largest crop and the largest inward carryover in her history, exported 332 million bushels net, some 14 million less than in 1923–24, when the crop was of about the same size (but better in quality) and the inward carryover somewhat smaller. Advance estimates of exports proved too low because they were based upon official crop estimates which now appear to have understated the crop. One striking feature of Canadian trade was the heavy movement from Pacific ports. Shipments through Vancouver alone exceeded 85 million bushels, some 25 million more than in any previous year. The large crop of Alberta, and a readjustment of railway rates enabling Vancouver to draw upon a wider territory, were the principal causes of this high figure. For the first time in history Vancouver apparently han-

[1] See Appendix Table XX for a classification of American wheat exports in recent years.

[2] These shipments (Duluth Board of Trade date) were as follows for the past six years August–July, in million bushels:

1922–23	44.6	1925–26	31.7
1923–24	21.0	1926–27	22.3
1924–25	35.3	1927–28	44.0

[3] See Appendix Table XXVI, and below, p. 86.

dled more Canadian wheat than Montreal, for Canadian exports through all Canadian seaboard ports totaled only 173 million bushels.[1] The heavy movement from Pacific ports made for the heaviest mid-winter movement ever recorded from Canada. Exports in April were abnormally small, in May not large,[2] stocks considered. But in June–July, with offers pressed, exports were larger than in any year since the war. During these months Canadian exports formed a higher proportion of the world exports than ever before.

In the course of the year Canadian wheat imported into the United States for milling in bond totaled 15.04 million bushels, 1.87 million more than in 1926–27 and 1.57 million more than in 1925–26. Imports for consumption, however, were again small, only about 150 thousand bushels.[3]

The volume of Argentine net exports, 178 million bushels, was the largest in history. Such heavy exportation was not foreseen early in the crop year. The crop was officially estimated as 239 million bushels, 8 million smaller than in 1923–24, when exports reached 172 million; and the rapid growth of domestic disappearance in Argentina suggested that exports of 1927–28 must fall well below the figure of 1923–24. It now appears that the crop of 1927 was considerably underestimated, perhaps by 30 million bushels more or less.[4] Exports during August–December were by no means large; but the January–July movement was of record size. Exports in these months totaled 148 million bushels, as against 138 million in 1924.[5] Free offers of Argentine wheat in competition with Canadian in the closing months of the year, when Argentine supplies are ordinarily insignificant, were an important factor in the drastic decline of prices during April–July.

Australia, with the shortest crop since 1922, naturally exported less wheat and flour than usual. Total net exports of 70 million bushels were not small, however, size of crop considered. Only 50 million bushels were exported from a crop of similar size in 1922–23. Unless the crop of 1927–28 was officially underestimated, Australian exports were made partly by reducing stocks.

Of the minor exporters, the Danube countries exported some 33 million bushels of wheat and flour. Of this quantity Hungary furnished 21.8 million and Roumania 7.5 million. Hungary, with a crop the largest in recent years and of excellent quality, exported a trifle less than in 1926–27; here, as in other Danube countries, short corn crops tended to restrict exports slightly. Jugo-Slavia's net exports were only a little more than a million bushels; her crop was the shortest since 1922, and in the winter months net imports were necessary. Roumania's exports held up surprisingly well in view of the relatively small crops both of wheat and of corn, especially the latter. Bulgaria exported a little over 2 million bushels, not so large a quantity as seemed possible in view of the distinctly large crop; here also the short corn crop tended to restrict wheat exports.

Net exports from India were 8.5 million bushels, the smallest since the war except for 1921–22, when India was a net importer, and 1925–26. Some imports from Australia were made in the winter months of 1927–28. The Indian crop was only of moderate size for the third successive year, and the new crop harvested in the spring of 1928 was quite small. Algeria and Tunis, and presumably Morocco, were able to export more than in 1926–27, largely toward the end of the year when the crop of 1928 promised exceptionally well. Data are not available for Chile, but the record crop presumably afforded relatively large exports during January–July 1928.

The lack of information from Morocco and Chile renders our estimate of total net exports subject to a margin of error, though not a large one. The totals are also incomplete in all years because exports from Uruguay, which must have been exceptionally large in 1927–28 on account of the large crop, are omitted for lack of data. Furthermore, wheat seems to have been exported from North Manchuria to Japan in 1927–28, but probably not in sufficient volume to place Manchuria as a whole in the list of net exporting countries.

[1] See Appendix Table XIV.

[2] See Appendix Table XX.

[3] See Appendix Table XIII.

[4] See above, p. 57.

[5] In 1920, January–July exports were 188 million bushels; but in that year the seasonal movement was exceptional, following the release of war-time stocks.

Furthermore, the very status of Russia is not clear. For the crop year July–June she was, according to official trade statistics, a net exporter of 7 million bushels of wheat. Most of these exports occurred in the first half of the year. The total crop was some 70 million bushels smaller than in 1926–27, and the crop lying near the exporting centers around the Black Sea was especially deficient. With consumption increasing, these factors alone seem sufficient to account for the decline in exports; for the difficulties involved in inducing peasants to part with grain appear to have been no greater in 1927–28 than in earlier years. During July Russia imported wheat, effecting simultaneous purchases in several continental ports. Neither the volume of these purchases nor their disposition has yet been made public. According to unofficial advices, some 11–13 million bushels were purchased in July–August, half of it moving to northern and half to southern Russia.[1] One may infer that a portion was used for seed and a portion for consumption. If, as seems probable, rather more than half of these imports occurred in July, then Russian imports for the crop year August–July may have balanced her exports; and we assume this balance in our estimate of total world net exports in August–July 1927–28. We employ July–June net exports from Russia in earlier years; and adjustments to an August–July year might slightly disturb the totals of world net exports.

All told, advance estimates of the total volume of international trade in 1927–28 proved much more accurate than in 1926–27, when early estimates, predicated partly upon trade in early months, proved far too low because the trade in the first half of the crop year was sharply curtailed by prevailing high ocean freight rates. Although the total movement in 1927–28 was foreseen with fair accuracy, there were significant errors of detail. The experience of 1927–28 teaches that such errors are to be avoided chiefly by the development of more adequate methods of estimating crops and of more precise measures of the quantities of wheat unmillable and fed to farm animals.

VI. THE YEAR IN MILLING

In our two preceding annual reviews we have set forth certain persisting characteristics of the milling situation in the United States, Canada, and various regions abroad, and have remarked the difficulties encountered in attempting to obtain a reliable appraisal of the situation in any one year. To repeat these observations in detail is unnecessary. It suffices to say that statistics of mill output, mill operation, and flour prices, as well as mill profits, are available for few countries; that devices are lacking to test the accuracy of impressions gained by perusal of milling journals; and that the general situation throughout the world is still characterized by milling capacity much in excess of annual flour requirements—a situation which gives rise to strenuous efforts to ease the strain of competition in numerous ways.

The milling situation varies greatly from country to country and from region to region within a country, and our present review deals chiefly with new or special features of detail. With respect to 1927–28, a few broad statements are warranted. Flour production was large, but international trade in flour was of about the same volume as in the two preceding years, probably a little smaller. Flour prices, like wheat prices, were in most countries presumably the lowest since 1923–24. Prices of millfeed, on the other hand, were exceptionally high in both North America and Europe. Milling industries located in countries where wheat crops were short and output was curtailed—in the soft red winter-wheat belt of the United States, in Australia, in Jugo-Slavia, and in Roumania—experienced a relatively unsatisfactory year; and for special reasons the situation was unsatisfactory in France. In most regions and countries the situation appears to have been somewhat better in 1927–28 than in 1926–27, though the milling quality of wheat was less satisfactory in the United States, Canada, and western Europe, and conversion costs may have been larger.

[1] See *Northwestern Miller*, October 31, 1928, p. 449.

International Trade in Flour

In 1927–28, for the fourth successive year, the volume of international trade in wheat flour showed a decline. Gross exports of flour, according to somewhat incomplete data of the International Institute of Agriculture, were as follows in the past six years, in million barrels:

1922–23	37.3	1925–26	38.3
1923–24	48.1	1926–27	38.2
1924–25	45.0	1927–28	37.1

Trade was exceptionally heavy in 1923–24 because of low prices which induced heavy importation in most countries, but especially in China, where the domestic wheat crop was short. In 1924–25, despite high prices, the volume of trade was again large on account of urgent needs in Europe, especially Germany and Poland.[1] In the other four years the volume has apparently varied within narrow limits. For some years there has been a tendency for the international movement of flour to decline relative to the trade in wheat, as importing countries have raised tariff barriers to protect domestic milling. But it is not possible to demonstrate the present existence of a downward trend in flour shipments in absolute figures, and there are numerous causes of variation in the annual volume of international trade in flour.

The United States, Canada, Australia, Argentina, India, Hungary, Roumania, and Japan have been the leading flour exporters of the world in recent years, and Canada and the United States combined have exported more than half of the total. In 1927–28, however, the major exporters as a group furnished a smaller proportion than usual, chiefly because high prices of millfeed in Europe favored domestic milling there. Canada, Argentina, Hungary, and Japan each exported more flour than in 1926–27, while the other four countries exported less. The decline in Australian gross exports was greatest, some 1.17 million barrels. Presumably the short crop with accompanying high prices, and restricted demand from Egypt, were responsible. Exports from the United States declined by some 605 thousand barrels; Canadian and Argentine competition, aided by the relatively high American prices prevailing during March–June, appears to have cut down exports to most destinations, China excepted. Distinctly short wheat crops reduced the gross exports of Jugo-Slavia and Roumania by 806 million barrels, or more than 62 per cent.

The increase in exports of Canada, Hungary, Japan, and Argentina, which totaled 1,646 thousand barrels, was much less than the aggregate decline in exports from the four other leading exporters, viz., 2,365 barrels. The increased exports of Hungary were in part fortuitous: Hungary benefited by the defection of Roumania and Jugo-Slavia, and to some extent by a heavy year-end movement produced by the announcement of an increase in the Austrian duty to take effect on July 15, 1928. Other changes were smaller in volume; but an increase in Japanese and a decrease in French exports were noteworthy. France became a net importer of flour for the first time during post-war years.

Among the European importing countries for which statistics are available, only the British Isles and Germany imported appreciably less flour in 1927–28 than in 1926–27. In these and other countries of western Europe, high prices of millfeed probably rendered milling operations relatively remunerative and permitted flour to be sold at relatively low prices. Greece also appears to have imported much less flour in 1927–28 than in 1926–27, though complete statistics are not available. Among the ex-European countries,[2] China alone appears to have imported appreciably more flour in 1927–28 than in 1926–27. Egypt, with a large crop of domestic wheat, took some 400 thousand barrels less; and Algeria became a net exporter rather than a net importer of flour.

Milling in the United States, 1927–28

The United States mill output was the smallest of the past five years, 1925–26 excepted.[3] We tentatively estimate the flour production in July–June 1927–28 as 115.8 million barrels, some 3.6 million less than in 1926–27. This estimate is subject to revision when the biennial census data for 1927

[1] See Appendix Tables III, XVIII.

[2] See Appendix Table XIX.

[3] See Appendix Table XXVI.

become available. If our figure is in error, it is presumably slightly too low. According to the monthly milling census, 968 identical mills produced 107.5 million barrels of flour in 1927–28 as against 109.1 million in 1926–27.

In general, this decline was perhaps due more to a decline in flour stocks in consumptive channels than to any other single factor. In the early months of the year, when wheat prices were declining, flour buyers, who held large stocks at the opening of the year, tended to purchase from hand to mouth, and mill output was curtailed. In the winter and spring purchases and mill output alike assumed larger seasonal volume; but with declining wheat prices in May-June flour buyers again curtailed their purchases sharply and presumably drew upon stocks. Hence milling output, though it remained at a high seasonal level in the second half of the crop year, was not so high as it would have been had not flour buyers curtailed their purchases toward the end of the year; and total output for the crop year was reduced thereby. The decline of flour stocks in consumptive channels[1] accounts largely for the decline in mill output; but one must at least mention the possibility that flour consumption per capita may also have declined.

Some of the factors making for comparative prosperity in 1926–27 were absent in 1927–28. In the first place, more wheat was required to produce a barrel of flour, some 4.689 bushels as compared with 4.639 bushels in 1926–27. But the rate of extraction in 1926–27 was considerably better than the average on account of the excellent quality of the hard red winter-wheat crop; and the rate for 1927–28 was somewhat higher than the average for the past four years.[2]

In the second place, although prices of ordinary wheat were lower, unusually high premiums for protein content prevailed, in contrast with unusually low premiums in 1926–27. The insurance afforded by hedging was consequently less adequate for the industry as a whole, though individual concerns may have profited by shrewd buying.

Other unfavorable features, the effects of which varied according to the sales policies of the various milling concerns, were unusual seasonal distribution of domestic demand and low flour prices. Seasonal concentration of demand in the first half of the crop year was conspicuously weak. The percentage of annual total flour output by identical mills reporting to the census in the first and second halves of the crop years 1924–25 to 1927–28[3] was as follows:

	July–December	January–June
1924–25	55.6	44.4
1925–26	54.6	45.4
1926–27	54.4	45.6
1927–28	52.7	47.3

The flour market was a buyer's market for most of the year. Millers were so concerned about getting business that many appear to have participated in destructive competition and price cutting. The return of the 5-cent loaf and bread-price wars in different parts of the country were factors in the situation. Flour buyers were slow to provide mills with shipping directions except during the notable advance in wheat prices in the spring. Millers probably lost more money than usual by extending credit to poor risks.

Throughout the year prices of millfeed were on an exceptionally high level, higher even than in 1926–27.[4] Beginning on a higher level than in July 1927, prices maintained this level until October and then climbed steadily to an extraordinarily high peak in March. After a recession in April, they reached the same high level again in May, after which they dropped precipitously, but still not to the level at which they commenced the year, and well above the level at which they began in 1926–27. One cannot say, of course, how far high prices for millfeed may have been offset by low flour prices and reduced output in the industry as a whole.

Milling census reports on percentage of capacity operated afford interesting re-

[1] This decline is not measurable, and the view that it occurred does not receive support from statistics of flour stocks held by city mills. See Appendix Table XXIV. Nevertheless indirect evidence suggests that such a decline took place.

[2] See above, p. 56.

[3] See also Appendix Table XXVI, which shows our estimates of domestic disappearance by months for the past five years.

[4] No satisfactory explanation of high prices of millfeed can be found in the general feed-grain situation in recent years. The problem will receive attention in a later issue of Wheat Studies.

gional comparisons with 1926–27. For the country and year as a whole, percentage of capacity operated was 55 per cent in 1927–28 compared with 56 per cent in 1926–27. Buffalo mills continued to maintain their usual high percentage of operation. Northwestern mills showed a moderate increase in average percentage of operation, owing to the larger spring-wheat crop of 1927. Southwestern mills maintained a high average operation, but not an exceptional operation as was the case last year. Pacific Coast mills enjoyed another good year in consequence of a large crop, good export demand from China, and the ability to compete in South Atlantic and Gulf ports with the soft wheat flour of the southern mills. The soft wheat milling industry of the southeastern states appears not to have fared so well. Percentage of capacity operated was not distinctly low, despite a short crop; but the total capacity appears to have been reduced, so that percentage operated in 1927–28 seems relatively more favorable than in fact it was. Moreover, the markets of southeastern mills were invaded in two directions: by shipments of Pacific flour via the Panama Canal to the Atlantic Coast; and, following a reduction of railway rates, by rail shipments via Ogden to the central western states.

In the important spring-wheat-producing states of Minnesota, North Dakota, South Dakota, and Montana, 257 mills produced 28.8 million barrels of flour in 1927–28 compared with a total of 28.7 million barrels produced by 264 mills in the same states last year; but larger mills produced more, smaller mills less.[1] In this region at least the smaller mills continued to drop out. The increase may have been due entirely to larger outturns of semolina and durum flour. According to census data, 2,317 thousand barrels of semolina were produced in 1927–28 as against 2,034 thousand in 1926–27; and production of durum flour increased from 674 to 764 thousand barrels.

Production in the three important winter-wheat-producing states of Kansas, Oklahoma, and Nebraska, and at the two principal Missouri River terminal market centers, Kansas City and St. Joseph, Missouri, was as follows, in thousand barrels:[2]

State or city	1926–27	1927–28	Percentage increase or decrease
Kansas	16,512	14,230	−16.0
Oklahoma	3,336	2,626	−37.0
Nebraska	3,674	3,546	− 3.6
Kansas City	7,218	7,451	+ 3.2
St. Joseph	1,992	1,541	−29.3
Totals	32,732	29,394	−11.3

This considerable decline, however, reflects mainly the exceptional situation in 1926–27, when the Southwest had a huge crop of excellent quality. Production was greater in 1927–28 than in any previous year except 1926–27. Kansas City mills are peculiar in showing increased production in 1927–28 because of the exceptional additions made to the size and number of the mills of that city in 1927 and 1928. Nebraska showed the least percentage of decline in production because of her large crop in 1927.

Flour exports showed a further decline of about half a million barrels, continuing a downward trend. Exports in 1927–28 were 12.9 million barrels, compared with 13.4 in 1926–27, a decrease of 3.7 per cent.[3] The decrease in value of exports of wheat flour, however, was from $90,387,000 to $83,866,000, a decline of 7.2 per cent. Canadian flour and Argentine flours were often quoted abroad at lower prices than American; hence competition was difficult. The largest decline in volume of exports occurred with respect to the United Kingdom, where our exports suffered as well as those of Canada. In Germany our exports suffered from competition with Canadian. Exports to Greece showed a considerable falling off as a result of tariff discrimination against flour in that market. Egyptian imports from the United States fell off about half, in part because of the Australian policy of consigning flour to that market, in part because Egypt required less flour from all sources. Increased trade with Cuba, the Philippines, and China partially offset these declines. Pacific Coast flour was apparently in the most favorable posi-

[1] See *Northwestern Miller*, October 31, 1928, p. 440.

[2] *Ibid.*, p. 441.

[3] Including shipments to possessions, the decline was from 14,023 to 13,471 thousand barrels. See Appendix Table XXVI.

tion to compete abroad this year, not only in the Orient but also in Europe. Exports of flour from customs districts of the Pacific Coast reached 3,766 thousand barrels in 1927–28 as against 2,798 thousand in 1926–27. Hence, since total flour exports decreased half a million barrels while Pacific Coast exports increased a million barrels, exports from other regions declined by nearly 1.5 million barrels.

Milling in Canada, 1927–28

Although Canada reaped one of the largest crops in her history, the percentage of lower grades of wheat ran high, and the amount of wheat required to produce a barrel of flour was the highest of the last five years. To just what extent lower freight rates on flour,[1] higher prices for millfeed, various forms of operating economies learned in recent years of hardship, and growing control by flour mills over the stronger baking organizations tended to offset these disadvantages, it is difficult to say. Certainly some of the most important milling concerns showed larger profits than in 1926–27.[2]

Total mill output was slightly over a million barrels larger than in 1926–27, 18.9 barrels compared with 17.8. The ratio of wheat flour exported to total flour produced remained the same as in 1926–27, 52 per cent, a fact significant in view of the alarm expressed so strongly last year over the declining trend of exports. The actual volume of exports improved by somewhat more than half a million barrels (from 9.2 million in 1926–27 to 9.9 in 1927–28), but remained less than the exports of the four years 1922–23 to 1925–26.

[1] An order of the railway board of Canada, dated August 26, 1927, to become effective as soon as new tariffs could be printed, lowered carrying charges on both wheat and flour and purported to correct certain regional discriminations. Besides facilitating the general export of flour, millers hoped that the change in rates would favor Canadian routes at the expense of the United States.

[2] Balance sheets or profit and loss statements for the Ogilvie Flour Mills, the Western Canada Flour Mills, the St. Lawrence Flour Mills, and the Maple Leaf Milling Company may be found in various milling journals.

[3] Exports of flour to the United Kingdom have been as follows in thousand barrels:

1923–24	4,112	1926–27	3,318
1924–25	2,685	1927–28	3,099
1925–26	3,368		

The increase in flour exports was not divided equally among all export destinations. Exports to the United Kingdom continued the decline which has been in evidence since 1923–24.[3] On the other hand, there was some improvement in the trade with continental Europe. Germany stood second to the United Kingdom as one of the chief importers of Canadian flour, and Canadian flour appears to find an increasing market as far east in Europe as Czecho-Slovakia and Poland. Although there was less open complaint in 1927–28 than in 1926–27 about the disparity between prices of Canadian wheat at home and abroad, attributed to the sales policies of the Canadian Pool, underlying discontent over the matter remains. The President of the Canadian National Millers' Association, at the annual meeting of the Association in September 1928, stressed this price disparity as one of the outstanding causes of the languishing export trade with the United Kingdom. As far as we have been able to ascertain, the Pool did not respond to the appeal made by the Association in May 1927 for wheat prices fully as favorable as those granted to foreign millers. Exports of flour to the Orient increased, China taking considerably more than in 1926–27 and Japan slightly less. Much low grade flour was available for the Chinese trade; but Japan tends to import less flour and more wheat.

The domestic situation is harder to appraise. In general, buyers of flour seem to have expected lower prices and to have bought cautiously throughout much of the year, a situation comparable with that in the United States. Since the crop was late, milling operations did not reach peak volume until November, a month later than usual. Operation averaged about 52 per cent of capacity for the year as a whole, compared with 55 per cent in the United States. There are indications that the westward movement of milling concerns for the present tends to accentuate the over-capacity of milling in Canada, for the rate at which new concerns or branches of old ones are built in the Western Division probably exceeds the rate at which old concerns are liquidated in the Eastern Division. In 1927 the Western Division produced more flour than the Eastern Division for the first time in history. Milling naturally tends to con-

centrate nearer to the wheat-producing centers. The recent adjustment of the freight rates and the development of shipping facilities in the western port of Vancouver promise to accelerate the movement in this direction.

Milling in Australia, 1927–28

The milling industries of the several Australian states operated under serious handicaps in 1927–28. The economical operation of mills in Australia is largely dependent upon the export trade in flour, which usually absorbs between 40 and 50 per cent of the flour produced. Milling costs are relatively high because of the protective tariff and the system of settling wage disputes by reference to the cost of living. Australian net exports of flour were over a million barrels less than in 1926–27 and the smallest since 1922–23, primarily as a result of a short wheat crop and relatively high wheat prices. In New South Wales and Victoria, the two most important milling states, most of this business is said to have been conducted at a loss in order to keep mills running and to maintain brands on the export markets. Western Australia was in a somewhat better position because of her large crop of wheat and her slight advantage in nearness to Far Eastern markets. It is stated that Western Australia in 1927–28 obtained business in markets which the eastern states had come to regard as their own. However, even in Western Australia the margin of profit is said to have been very small. The eastern states were particularly disturbed by New Zealand's imposition of an anti-dumping duty on flour.[1] The Union of South Africa also has an anti-dumping duty on Australian flour. The Egyptian market was early flooded with Australian flour on consignment. In the domestic market, buyers of flour had the advantage over millers. Competition between mills for business was very keen. Even the millers of Queensland complained that Sydney millers were dumping flour in their state. New South Wales millers were unfortunate in having to fulfil flour contracts made at low prices by grinding wheat purchased at high prices.[2] Millers in this state were also handicapped by a relatively high rate of extraction. There were bread-price wars in both New South Wales and Victoria.

Milling in Argentina in 1927

Argentine milling statistics are reported for calendar years. In respect to both per capita domestic consumption and volume of exports, 1927 was a record year. A greater percentage of capacity was utilized than in 1926, but even so, of the 336 mills included in the official records, 149 remained idle. Percentage extraction was 70.2 compared with 68.4 in 1926 and an average of 70.0 for the five years 1921–25. Since the crop milled in 1926 was of unusually poor quality, the percentage extraction of that year was abnormally low; but in 1927 the extraction ratio was average or better. Wheat milled, flour produced, and flour exported in thousand tons, and percentage of extraction during the last six calendar years, were as follows:

Year	Wheat milled	Flour produced	Percentage extraction	Exports
1922	1,309	913	69.8	114
1923	1,343	936	69.7	82
1924	1,691	1,196	70.7	175
1925	1,634	1,155	70.7	137
1926	1,701	1,164	68.4	142
1927	1,845	1,294	70.2	170

Flour exports were the largest in volume since 1924. Brazil took over 50 per cent of the total. While exports of flour to the United Kingdom for the calendar year 1927 show a decrease, imports of flour from Argentina into the United Kingdom for the crop year 1927–28 show an increase. Some of the flour shipped "to orders" undoubtedly went to the United Kingdom. Among the principal exporters of flour to the United Kingdom, Argentina alone appears to have shipped more flour in 1927–28 than in 1926–27.

[1] The New Zealand duty on flour, effective September 13, 1927, was a complex one based on the export price of flour. It created many difficulties for Australian exporters.

[2] Bakers usually buy three months' supplies in January, but in 1927–28 delayed their buying until February when flour prices were low. Millers, anticipating the usual seasonal buying, bought early from the short crop at high prices. When wheat prices dropped in February, farmers held wheat to such an extent that millers were forced to bid the price up in order to obtain supplies to fill their flour contracts.

Milling in Europe, 1927–28

The picture of milling in Europe, though still not bright, is less dark than that of 1926–27. Readjustment to post-war boundaries and much-needed liquidation of excessive capacity have continued, though by no means without expressions of dissatisfaction. Larger crops of native wheat in the majority of countries, lower prices for import wheat, and higher prices of millfeed, were generally favorable factors. Most countries imported more flour in 1927–28 than in 1926–27, and this may have worked to the disadvantage of domestic mills. But the situation varied from country to country.

Among the wheat and flour exporting countries of the lower Danube, Hungary had a large crop, of better quality than any in the post-war period. Several circumstances combined to enable Hungary to increase her exports of flour. In the first place, the quality of Hungarian flour was improved by the better quality of the wheat, and the flour regained some of its lost standing in export markets. Because of a pending increase in Austrian duties on wheat and flour, both wheat and flour flowed into Austria in anticipation of the advance, which finally became effective on July 15, 1928. An agreement with Czecho-Slovakia, signed on August 8, 1927, in which some concessions were granted to Hungary, enabled Hungary to sell more flour in that country. Under special dispensation of the Ministers of Finance and of Industry and Trade of Poland, appreciable quantities of Hungarian flour were allowed to enter Poland in spite of the general import restriction. The domestic market seems also to have improved somewhat. Millers lowered the price of export flours to attract foreign buyers, but raised the price on the home market, apparently with some success.[1] Millers may also have profited in the spring of 1928 when advancing world wheat prices caused a flurry of flour buying in European markets.[2] Furthermore, prices of millfeed were highly remunerative in 1927–28, owing to a general shortage of fodder crops, especially corn, in Hungary and other countries.

Bulgaria, which also produced a large crop in 1927–28, was probably in somewhat the same position as Hungary. The large crop was mostly ground in domestic mills, and exports were mainly in the form of flour. Jugo-Slavia probably took some Bulgarian flour, at least until her import duty was doubled on April 14, 1928. In Roumania and Jugo-Slavia, which harvested short crops in 1927, milling conditions were distinctly unfavorable. In Jugo-Slavia the wheat crop was barely sufficient to cover home requirements, mills could not operate to as great a capacity as usual, and some flour was imported. To stop this importation, on April 14, 1928, the import duty was raised from 4 gold dinars to 8 gold dinars (conventional rate). The scarcity of wheat, and other factors making for high operating costs, made the grinding of wheat so expensive that 26 mills went bankrupt and 15 stopped grinding in 1927, the others utilizing no more than about 30 per cent of capacity. Similar but presumably less extreme conditions appear to have prevailed in Roumania. A reduction in export duties on both wheat and flour, as of October 20, 1927, seems not to have relieved the situation notably.

Austria, Czecho-Slovakia, and Poland all harvested larger crops in 1927 than in 1926. The Austrian parliament revised the tariff rates upward on wheat and flour in late October 1927, but the new duties[3] did not become effective, owing to negotiations with Hungary, until July 15, 1928. Imports of flour in 1927–28 increased slightly over those of 1926–27, chiefly because consignments were sent into Austria in advance of the imposition of the new rates. Austrian mills resented this influx of foreign flour at low prices, and many were forced to close down. Milling conditions in Czecho-Slovakia in 1927–28 were probably somewhat less favorable than in the previous year, especially since a treaty with Hungary, signed May 31, 1927 and effective as of August 8, 1927, permitted some Hungarian flour to enter the market in competition

[1] *Pesti Naplo* (Budapest), July 26, 1928.

[2] It was stated in August (*ibid.*, August 10, 1928) that Hungarian mills had sold such large quantities of flour to European importing states that if they could not sell one kilogram of flour during the near future, the Budapest mills could work for 3 months up to 100 per cent capacity to fill standing orders.

[3] The present conventional rate amounts to a change from 0.25 gold crowns to 2 gold crowns on wheat and from 1.70 gold crowns to 5 gold crowns on flour.

with domestic flour. On the other hand, domestic milling was favored by the large domestic crop and the import certificate system in force since August 1926.[1] There has been agitation, as in other central European countries, to re-establish futures trading in order that millers may protect themselves by hedging.

In Poland the government has continued actively to try to favor both grain growers and millers. To prevent the export of grain early in the crop year and subsequent importations, export duties of 20 zloty per 100 kilos were placed on wheat and flour, effective from November 29, 1927 to June 30, 1928. In addition the government imposed import prohibitions on wheat and flour as of December 4, 1927, the prohibition on wheat being removed as of April 30, 1928, while that on flour continued throughout the crop year. These prohibitions, however, were lifted in certain instances by agreement of the Ministers of Finance and of Industry and Trade. Imports of flour were then subject to the import duty of 15 zloty. As of March 15, 1928, import duties on most commodities were increased by 30 per cent to compensate for the depreciation of the zloty, and flour was one of these. In addition to this control of exports and imports, the government regulated the domestic wheat and flour market in other ways.

In Great Britain, domestic millers in 1927–28 supplied a larger share of total flour supplies than in 1926–27. Business, however, was done at much lower prices and was highly competitive. There was less complaint about "dumping" of foreign flour; importers experienced great difficulty in trying to place flour on this market. British millers were in a better position partly on account of high prices for millfeed, which does not lend itself to ocean transportation so well as wheat. Imports of flour were reduced by about three-quarters of a million barrels over 1926–27, while wheat imports remained approximately the same. Argentina furnished a notably larger portion of the total flour imports; the United States and Canada combined supplied a notably smaller portion than usual. According to export statistics of the United States and Canada (more reliable as to sources of imports than are British import figures), the United States exported to the United Kingdom over half a million barrels less and Canada about a quarter of a million barrels less. This was to be expected in view of the fact that Canadian flour was cheaper than United States flour during most of 1927–28. Although Great Britain harvested the largest crop since 1923, so great a percentage of it was damp and unmillable that comparatively little of it reached the mills until the second half of the year. Large arrivals of foreign wheat at low prices, and a high return for millfeed, enabled millers to produce in large quantities in the first quarter of the year.

In the Irish Free State the milling situation was unimproved in 1927–28. The Tariff Commission completed its hearings in August 1927 and rejected the appeal of the Irish Flour Mills Association for a tariff on flour of 3 shillings per 280 pounds. Agitation for some sort of legislation on behalf of millers is nevertheless still keen. In comparison with the English and Scotch industries with respect to supplies of wheat, the Irish milling industry is handicapped by its unfavorable geographical location. Another factor is the higher wage scale in Ireland.

The situation in Germany is far from clear. In 1927–28, as in most years of the post-war period, much dissatisfaction was expressed in milling circles. The wheat crop of 1927 was large, but much of it was damp and created difficulties in the milling process. Millers complain that flour consumption is declining[2] and that milling capacity tends to increase too rapidly because large mills are built faster than smaller and older competing concerns can go out of business. Mergers have been undertaken and price fixing and agreements concerning sales have been entered into. On the whole there can be no question that the German milling industry is overextended and that profitable operation is difficult. Yet the evidence indicates that the year 1927–28 was less unsatisfactory than most of its recent predecessors. Even with allowance for a considerable proportion of unmillable wheat in the domestic crop,

[1] The import certificate system enables millers to export flour of lower grades which, prior to the establishment of the system, could not be consumed by the domestic market nor exported profitably.

[2] The evidence hardly bears out this assertion. See above, p. 59.

total available wheat supplies were the largest in recent years and one may infer that milling output was correspondingly large. Furthermore, German milling was apparently sufficiently efficient to bring imports of flour to the lowest figure in post-war years and to increase flour exports to such a degree that the net import of flour in 1927–28 was only 2 thousand barrels as compared with over 5 million in 1924–25.

France was a net importer of flour in 1927–28, an unusual occurrence in the face of a large crop of domestic wheat, a large carryover, and fairly low prices of foreign wheat. The occurrence was the net result of reduced exports of flour and increased imports of flour. Exports were only a third as large as those of 1926–27; imports were over twice as great. Changes in and uncertainty over the tariff on wheat and flour were responsible for a large share of the difficulties of millers. The following changes, in francs per 100 kilos, were made in the tariff on wheat and flour in 1927–28:

	Wheat	Flour (70 per cent extraction)
Previous rate	18.20	37.40
Effective September 3, 1927	25.00	45.00
Effective November 19, 1927	35.00	60.00

The tariff effective from September 3 to November 19, while raising the duties, did not raise the duty on flour to the same extent as that on wheat. Thus wheat during this period was expensive and imports of foreign flour entered to compete in the flour market. The new rates effective November 19 restored relative protection to flour, but they were so highly protective to both wheat and flour that the cost of production of flour made competition of French flour with other flour in foreign markets practically impossible. It is also pertinent to recall that this year no reimbursement of wheat duty was allowed millers grinding wheat for domestic consumption. Revaluation of the franc had the effect of removing the abnormal stimulus to exports previously resulting from the depreciating franc. The poor quality of the French crop necessitated admixture with foreign wheat to produce a blend acceptable to flour purchasers, and also a higher rate of extraction. In the face of these facts, a reduction in the official rate of extraction, a lowering of the percentage of admixture of other cereals, and removal of the export restriction on wheat and flour, did little to ameliorate conditions.

Italy had the smallest crop of wheat since the very small crop of 1924. The small crop, combined with the protective tariff, made the Italian price of wheat extremely high during the year compared with other European markets, as has been true in earlier years. High taxes and government control of wages also made for high flour production costs. Milling regulations requiring high extraction of flour were continued, and appreciation of currency tended to encourage flour imports. Imports increased by 10 thousand barrels, but exports increased by 25 thousand barrels in 1927–28. The large export was largely fortuitous. The poor crop of Jugo-Slavia and the desperate condition of the milling industry of that country, and the tariff uncertainty in Austria, probably encouraged export of Italian flour to those countries.

Before the war, Belgium, because of her favorable location at the crossroads of Europe, was in a position profitably to grind imported wheat and to export flour. Since the war, tariff barriers erected by flour-importing countries have made this business difficult. In 1926–27 Belgium's net export of flour was only 64 thousand barrels. In 1927–28, however, net exports recovered to the level of 1925–26, 152 thousand barrels. Germany and Holland were formerly the chief importers of flour from Belgium. The German market is effectively closed by a high protective duty on flour. In the Dutch market Canadian flour competes severely with that from Belgium, with the domestic product, and with flour from other foreign countries. Hence the recovery of flour exports is difficult to explain. Belgian millers, like the English, probably benefited from prevailing high prices for millfeed. Moreover, France, usually an exporter to Belgium, may have been a customer this year because revaluation of the French franc made French flour relatively more expensive than Belgian, and because the changes in the French tariff tended to favor flour imports during part of the year.

The milling industries of Denmark and Holland, which in the pre-war period had been quite prosperous, have suffered in the

post-war period from severe competition from flour both from overseas and from neighboring countries. In both countries consumers have become accustomed to imported flour and have acquired a preference for it. In Holland the abolition of night work in bakeries (part of a broad program of social legislation) has necessitated greater use of hard wheat flours. This fact favors flour imports.

In 1927–28 Spain had the smallest crop of wheat since 1924. For most of the year the embargo on foreign wheat and flour was continued, but the scarcity of wheat finally led to its removal on wheat as of May 3, 1928. For the protection of millers the government has continued to try out various elaborate measures. A measure published August 29, 1927, permitted the importation of a maximum of 50 thousand tons of wheat during six months, the flour from which must be exported in three months in order to receive reimbursement of the import duty. The object of this measure was to increase employment in the flour mills. To facilitate the movement of the crop to the mills, freight rates were reduced 10 per cent in the early part of 1928. The milling industry is protected by an extraordinarily high duty on flour of 21 pesetas (gold), and in addition the embargo on flour continues.

The situation in Greece presents an interesting picture. As part of an effort to balance the budget through increasing tariff revenues, the duties on both wheat and flour were raised to a high level in July 1927. The duty on wheat amounts to approximately $2.00 per 100 kilos and that on flour to about $3.55. Under this schedule flour imports have been much curtailed, and the increased revenues from wheat imports have scarcely made up for loss of revenue on flour imports. The restriction of flour imports has not aided domestic milling industries, as was anticipated. As a result of the ability of small grist mills effectively to compete because of a high legal extraction rate, internal competition has spoiled the market for the larger commercial mills.

A definite picture of the Russian milling situation cannot be secured. The Soviet Government is apparently attempting to restore the industry. The plan is to unite all mills into a small number of organizations and to lend special support to cooperative mills. Early in 1928 the sum of about three and a half million dollars was voted by the government for the refurbishing of existing mills and the erection of new ones. The cost of production of flour in Russia is still so high relative to costs in other countries that profitable exportation of flour is impossible.[1]

Milling in the Orient, 1927–28

In China, the important group of mills at Shanghai, despite favorable supply conditions in Kiangsu Province, appear to have experienced a rather unsatisfactory year. Flour prices were not remunerative in either the domestic or export markets. Contrary to the experience of the past four years, wheat and flour prices declined from September to May, causing losses to many millers accustomed to speculate in wheat in the opening months of the season. The low point in flour prices was reached in December and was reflected in the low operation of about 40 per cent of capacity in January and February. Earlier and later in the crop year operation was maintained at about 80 per cent of capacity. Shanghai grinds wheat chiefly for export to other Chinese ports; her exports represent three to four times the amount ground for local consumption. In 1927–28 there was a large rice crop in the Shanghai region, so that rice competed more severely than usual with flour. But the export situation seems chiefly responsible for the unremunerative flour price. Of the average export of Shanghai, North China ports usually take about 75 per cent, South China ports about 20 per cent. In 1927–28 trade with the South Manchurian port of Dairen was reduced to exceptionally small proportions because a large crop in North Manchuria served to furnish flour enough for South Manchuria as well as for North Manchuria. On the other hand, exports to Tientsin and South China increased perceptibly. Trade within

[1] The *Northwestern Miller* (May 2, 1928, p. 464) reported that Russian flour was being sold in Egypt below cost, in competion with Australian flour. Exporters of flour are given a license by the Soviet to import an equivalent amount of value of other products. Import goods procured in this way can be sold at an enormous profit, enough to offset the losses on flour exported and more in addition.

the local area near Shanghai was rendered difficult by transportation troubles on the Yangtze, inadequate protection of goods in transit, and arbitrary taxes levied by different military leaders.

Mills in and around Harbin had a good year, the best in several years, owing to the excellent wheat crop of North Manchuria. The capacity operated was almost 100 per cent for a good part of the year. A large volume of flour was exported to South Manchuria for the first time since 1922 and almost sufficed to supply import requirements there. This movement considerably curtailed imports into South Manchuria through the main port of entry at Dairen. Probably only Japan, which has peculiar connections and facilities for quick delivery in that port,[1] was able to do a profitable export business there in 1927–28. Imports from Shanghai and foreign countries other than Japan were estimated at only a third of the amounts in 1926–27.

The milling situation in Tientsin and Tsinan is less clear. Tientsin milled less flour in 1927 than in 1926 and imported larger quantities of flour, perhaps because the wheat crop of the neighborhood was smaller, perhaps because transportation of wheat to mills was hampered, perhaps because cheap flour from Shanghai competed severely. The total trade assumed larger proportions than in 1926.

All told, so far as can be judged from export statistics of the United States, Canada, and Australia, imports of flour into China were somewhat larger in 1927–28 than in 1926–27. Exports of flour as wheat from these countries to China, Hongkong, and Kwantung totaled 14.33 million bushels as against 8.99 bushels in the preceding year.[2] Increased takings of the Tientsin, South Manchurian, and South China areas appear to have more than offset decreased takings of the Shanghai region.

The Japanese milling industry appears to have progressed in 1927–28. The difficulties attendant upon a rapid expansion (amounting in the six years 1921–26 to over 40 per cent) are slowly being overcome. The rapid expansion (fostered by the protective tariff on flour, and the rebate of the wheat duty on exportation of flour) and the consequent cutthroat competition in both domestic and export markets, which was responsible for great difficulties in the industry in 1926, have been retarded by restrictions on production, price agreements, and reduction in exports. Agreements between the chief milling companies of Japan in regard to restriction of output, effective on June 1, 1926[3] and operative until June 1, 1928, served to curtail production with respect to the domestic market to the extent of 40 per cent in the case of the largest mills. The agreement did not affect output for export. Domestic consumption has supposedly been increasing rapidly, but there is some evidence that the effect of the tariff in raising flour prices has curtailed the natural increase of consumption in the past two years. Domestic demand was probably somewhat curtailed in 1927–28 by low prices for rice. But recovery from the general business depression has been especially noticeable in 1928 and has been an influence in the opposite direction. Millers were favored by a large domestic crop of wheat in 1927 and by the fact that foreign wheat could be had in the autumn at low prices. Those millers who laid in stocks of foreign wheat at low prices profited later when prices rose toward the end of the year.

Gross exports of flour, which in 1925–26 amounted to 1,020 thousand barrels, and in 1926–27 fell off to only 746 thousand barrels, increased in 1927–28 to 1,155 thousand barrels. This figure, however, presumably represents a profitable export business, whereas the high exports of 1925–26 represented an unprofitable dumping trade. Japan, along with other flour exporters, did an increased volume of business with the North China port of Tientsin in 1927–28 and was probably the only exporter to do a profitable business with the South Manchurian port of Dairen in 1927–28.

[1] The port of Dairen is located in Japanese leased territory and the import business is in the hands of a few strong Japanese organizations.

[2] See Appendix Table XIX.

[3] See WHEAT STUDIES, IV, 41.

This issue is chiefly the work of M. K. Bennett, with substantial assistance from Joseph S. Davis, Katharine Merriam, Janet Murray, and Alonzo E. Taylor

APPENDIX

TABLE I.—WHEAT ACREAGE IN PRINCIPAL PRODUCING AREAS, 1920–28*

(*Million acres*)

Year	United States	Canada	India	Australia	Argentina	Chile	Uruguay	Hungary	Bulgaria	Jugo-Slavia	Roumania	Soviet Russia	Mexico
1920	61.14	18.23	29.95	9.07	13.22	1.26	.70	2.66	2.17	3.56	5.00	.....	....
1921	63.70	23.26	25.78	9.72	14.10	1.34	.81	2.89	2.23	3.70	6.15	.....	2.28
1922	62.32	22.42	28.21	9.76	16.06	1.47	.66	3.52	2.30	3.67	6.55	.....	2.62
1923	59.66	21.89	30.85	9.54	17.04	1.54	1.06	3.29	2.38	3.84	6.65	39.16	3.05
1924	52.54	22.06	31.18	10.82	15.98	1.43	.85	3.50	2.49	4.24	7.84	52.73	1.40
1925	52.26	20.79	31.78	10.20	17.62	1.43	.96	3.52	2.55	4.31	8.16	59.77	1.13
1926	56.34	22.90	30.47	11.69	18.26	1.46	.99	3.71	2.62	4.18	8.22	70.87	1.29
1927	58.78	22.46	31.30	11.82	19.71[a]	....	1.04	4.05	2.66	4.63	7.66	75.94	1.31
1928	57.72	24.12	32.21	14.00	20.90[a]	....	....	4.13	2.82	4.48	7.92	66.68	1.25
Average													
1909–13	47.10	9.94	29.22	7.60	14.88	1.00	.79[b]	3.71	2.41	3.98	9.52[b]	74.21	2.17[c]
1922–26	56.62	22.01	30.50	10.40	16.99	1.47	.90	3.51	2.47	4.05	7.48	55.63[b]	1.90

Year	Morocco	Algeria	Tunis	Egypt	British Isles	France	Germany	Italy	Belgium	Netherlands	Denmark	Norway	Sweden
1920	1.99	3.45	1.32	1.19	1.98	12.59	3.40	11.29	.31	.15	.18	.04	.36
1921	1.96	3.04	1.49	1.46	2.08	13.30	3.56	11.88	.34	.18	.22	.04	.36
1922	2.07	3.74	1.07	1.52	2.07	13.07	3.40	11.40	.30	.15	.24	.02	.36
1923	2.25	3.17	1.61	1.54	1.84	13.67	3.65	11.45	.35	.15	.20	.03	.36
1924	2.46	3.53	1.24	1.42	1.63	13.62	3.62	11.28	.34	.12	.15	.02	.32
1925	2.62	3.61	1.62	1.38	1.57	13.87	3.84	11.67	.36	.13	.20	.02	.36
1926	2.56	3.74	1.84	1.53	1.68	12.97	3.96	12.15	.35	.13	.25	.02	.38
1927	2.30	3.47	1.40	1.65	1.71[d]	13.06	4.36	12.30	.39	.15	.27	.02	.40
1928	2.35	3.59	1.73	....	1.46[d]	12.80	4.28	12.30	.43	.15	...	...	...
Average													
1909–13	1.70	3.52	1.31	1.31	1.89	16.50	4.03	11.79	.40	.14	.15	.01	.26
1922–26	2.39	3.56	1.48	1.48	1.76	13.44	3.69	11.59	.34	.14	.21	.02	.36

Year	Spain	Portugal	Switzerland	Austria	Czecho-Slovakia	Poland	Finland	Latvia	Esthonia, Lithuania	Greece	Japan, Chosen	South Africa	New Zealand
1920	10.25	1.10	.12	.37	1.57	1.79	.02	.04	.19	1.08	2.18	.88	.22
1921	10.39	1.09	.12	.38	1.56	2.09	.03	.05	.21	.95	2.14	.99	.35
1922	10.31	1.16	.11	.46	1.53	2.57	.04	.07	.25	1.06	2.12	.85	.28
1923	10.49	1.05	.11	.48	1.51	2.51	.04	.11	.26	1.06	2.07	.78	.17
1924	10.38	.94	.10	.48	1.50	2.65	.04	.11	.25	1.15	2.03	.75	.17
1925	10.72	....	.10	.48	1.53	2.70	.04	.12	.33	1.15	2.04	.97	.15
1926	10.78	1.06	.13	.50	1.55	2.72	.04	.12	.36	1.15	2.04	.88	.22
1927	10.83	1.08	.13	.50	1.58	2.81	.04	.14	.30[e]	1.14	2.06	...	.26
1928	10.75	....	.13	.50	1.61	2.67	.04	...	.40[e]	1.31	....	...	...
Average													
1909–13	9.55	1.21[f]	.10	.64	1.72	3.35	.01	.08	.23	1.13[g]	1.75	.74[b]	.24
1922–26	10.54	1.05[b]	.11	.48	1.52	2.63	.04	.10	.29	1.11	2.06	.85	.20

* Data of U.S. Department of Agriculture for 1909–13, including U.S. Department of Agriculture estimates for area within post-war boundaries. Figures for 1928 are preliminary. Dots (...) indicate that data are not available.

[a] Estimate for area sown, not harvested.
[b] Four-year average.
[c] Two-year average.
[d] Excluding Irish Free State.
[e] Lithuania only.
[f] Three-year average.
[g] One year only.

TABLE II.—WHEAT YIELD PER ACRE IN PRINCIPAL PRODUCING AREAS, 1920–28*

(Bushels per acre)

Year	United States	Canada	India	Australia	Argentina	Chile	Uruguay	Hungary	Bulgaria	Jugo-Slavia	Roumania	Soviet Russia	Mexico
1920	13.6	14.4	12.6	16.1	11.8	18.4	11.1	14.2	13.8	12.1	12.3	....	...
1921	12.8	12.9	9.7	13.3	13.5	17.6	12.3	18.3	13.1	14.0	12.8	....	2.2
1922	13.9	17.8	13.0	11.2	12.2	17.6	7.8	15.5	14.2	12.1	14.1	....	5.2
1923	13.4	21.7	12.1	13.1	14.5	18.2	12.6	20.6	12.2	15.9	15.4	10.7	4.5
1924	16.5	11.9	11.6	15.2	12.0	17.1	11.7	14.7	9.9	13.6	9.0	9.0	7.4
1925	12.9	19.0	10.4	11.2	10.8	18.7	10.4	20.3	16.2	18.2	12.8	12.2	8.1
1926	14.8	17.8	10.7	13.8	12.1	15.9	10.3	20.2	14.0	17.1	13.5	11.6	8.0
1927	14.9	19.6	10.7	9.3	12.1	....	13.4	19.0	17.8	12.2	12.6	9.9	9.1
1928	15.6	20.8	9.0	10.7	11.0	....	....	22.3	18.0	23.5	14.6	12.9	9.1
Average 1909–13	14.7	19.8	12.0	11.9	9.9	20.0	8.2[a]	19.3	15.7	15.6	16.7[a]	10.2	...
1922–26	14.3	17.6	11.5	13.0	12.3	17.5	10.8	18.3	13.3	15.5	12.8	11.0[a]	6.0

Year	Morocco	Algeria	Tunis	Egypt	British Isles	France	Germany	Italy	Belgium	Netherlands	Denmark	Norway	Sweden
1920	9.0	4.7	4.0	26.6	28.7	18.8	24.3	12.5	33.6	39.4	41.1	25.0	28.8
1921	11.9	9.4	6.0	25.4	35.4	24.3	30.3	16.3	42.3	47.6	50.7	23.7	34.3
1922	6.2	5.1	3.4	23.7	31.5	18.6	21.2	14.2	35.4	41.1	39.0	25.7	26.7
1923	8.9	11.3	6.2	26.5	31.8	20.2	29.1	19.6	38.8	40.3	43.2	23.5	30.4
1924	11.7	4.9	4.2	24.1	33.0	20.6	24.6	15.1	38.2	39.9	39.4	23.5	21.1
1925	9.1	9.1	7.2	26.2	34.1	23.8	30.8	20.6	39.7	42.9	49.2	22.3	36.8
1926	6.3	6.3	7.1	24.3	31.0	17.9	24.1	18.2	36.6	41.6	35.4	26.6	31.9
1927	10.7	8.2	5.9	26.9	32.6[b]	21.1	27.6	15.9	41.7	40.8	35.0	30.2	28.2
1928	9.4	9.5	6.9	....	32.9[b]	21.7	29.6	19.2	41.5	50.5	....	....	....
Average 1909–13	10.0	10.0	4.8	26.0	31.6	19.7	32.6	15.6	37.6	36.1	41.1	25.5	31.8
1922–26	8.5	7.2	5.9	25.0	32.2	20.3	26.1	17.6	37.6	41.1	40.9	23.3	29.6

Year	Spain	Portugal	Switzerland	Austria	Czecho-Slovakia	Poland	Finland	Latvia	Esthonia, Lithuania	Greece	Japan, Chosen	South Africa	New Zealand
1920	13.5	9.4	30.1	14.6	16.8	12.7	12.1	10.0	13.4	10.4	18.9	8.7	31.2
1921	14.0	7.4	32.5	17.3	24.9	17.9	20.7	17.0	15.9	10.8	18.6	8.8	29.9
1922	12.2	8.5	22.7	16.1	22.0	16.5	18.7	13.7	17.0	8.5	18.5	7.4	30.4
1923	15.0	12.5	34.5	18.7	24.0	19.8	17.2	15.5	14.3	8.3	17.0	7.7	24.0
1924	11.7	9.1	29.9	17.6	21.5	12.3	21.4	14.9	15.2	6.7	18.4	9.5	32.6
1925	15.2	....	33.5	22.0	25.8	21.4	25.1	18.2	18.5	9.8	19.7	9.5	30.4
1926	13.6	8.1	33.4	18.9	22.0	17.3	23.7	15.2	13.9	9.7	19.1	9.1	36.1
1927	13.4	10.6	32.4	23.7	25.6	19.3	27.3	18.8	17.8[c]	11.7	19.6	...	36.5
1928	12.1	....	33.6	23.9	25.8	20.2	20.9	....	18.4[c]	12.6	....	...	....
Average 1909–13	13.7	....	31.6	20.2	22.0	19.0	17.1	17.4	15.5[d]	14.4	18.2	8.4[a]	28.7
1922–26	13.5	9.6[a]	30.9	18.7	23.1	17.4	21.3	15.6	15.7	8.6	18.3	8.7	30.9

* Computed from acreage and production figures in Appendix Tables I and III. Dots (...) indicate that data are not available.

[a] Four-year average.
[b] Excluding Irish Free State.
[c] Lithuania only.
[d] One year only.

TABLE III.—WHEAT PRODUCTION IN PRINCIPAL PRODUCING AREAS, 1920–28*

(Million bushels)

Year	United States	Canada	India	Australia	Argentina	Chile	Uruguay	Hungary	Bulgaria	Jugo-Slavia	Roumania	Soviet Russia	Mexico
1920	833.0	263.2	377.9	145.9	156.1	23.2	7.8	37.9	29.9	43.0	61.3	.....	15.0
1921	814.9	300.9	250.4	129.1	191.0	23.6	10.0	52.7	29.2	51.8	78.6	.....	5.1
1922	867.6	399.8	367.0	109.5	195.8	25.9	5.2	54.7	32.6	44.5	92.0	.....	13.6
1923	797.4	474.2	372.4	125.0	247.8	28.1	13.3	67.7	29.1	61.1	102.1	419.1	13.7
1924	864.4	262.1	360.6	164.6	191.1	24.5	9.9	51.6	24.7	57.8	70.4	472.3	10.4
1925	676.4	395.5	331.0	114.5	191.1	26.7	10.0	71.7	41.4	78.6	104.7	729.9	9.2
1926	831.0	407.1	324.7	160.8	220.8	23.3	10.2	74.9	36.5	71.4	110.9	819.6	10.3
1927	878.4	440.0	335.0	109.9	239.2	33.5	13.9	76.9	47.3	56.6	96.7	749.0	11.9
1928	902.7	500.6	289.8	150.0	.....	....	....	92.0	50.7	105.4	115.6	859.8	11.3
Average 1909–13	690.1	197.1	351.8	90.5	147.1	20.1	6.5[a]	71.5	37.8	62.0	158.7[a]	758.9[b]	11.5[a]
1922–26	807.4	387.7	351.1	134.9	209.4	25.7	9.7	64.1	32.9	62.7	96.0	610.2[a]	11.4

Year	Morocco	Algeria	Tunis	Egypt	British Isles	France	Germany	Italy	Belgium	Netherlands	Denmark	Norway	Sweden
1920	17.9	16.2	5.2	31.7	56.8	236.9	82.6	141.3	10.3	6.0	7.4	1.00	10.3
1921	23.2	28.5	9.0	37.0	73.8	323.5	107.8	194.1	14.5	8.6	11.1	.97	12.3
1922	12.9	18.9	3.7	36.0	65.2	243.3	71.9	161.6	10.6	6.2	9.2	.64	9.5
1923	20.0	35.8	9.9	40.7	58.5	275.6	106.4	224.8	13.4	6.2	8.9	.59	11.0
1924	28.8	17.3	5.2	34.2	53.9	281.2	89.2	170.1	13.0	4.7	5.9	.49	6.8
1925	23.9	32.7	11.8	36.2	53.7	330.8	118.2	240.8	14.5	5.6	9.7	.49	13.4
1926	16.2	23.6	13.0	37.2	52.2	231.8	95.4	220.6	12.8	5.5	8.8	.59	12.2
1927	24.6	28.3	8.3	44.3	57.2	276.1	120.5	195.8	16.3	6.2	9.4	.60	11.3
1928	22.2	34.0	12.1	37.3	49.6	277.7	126.5	228.6	17.8	7.6	9.0	.68	11.3
Average 1909–13	17.0	35.2	6.2	34.2	59.6	325.6	131.3	184.4	15.2	5.0	6.3	.31	8.1
1922–26	20.4	25.7	8.7	36.9	56.7	272.5	96.2	203.6	12.9	5.6	8.5	.56	10.6

Year	Spain	Portugal	Switzerland	Austria	Czecho-Slovakia	Poland	Finland	Latvia	Esthonia, Lithuania	Greece	Japan, Chosen	South Africa	New Zealand
1920	138.6	10.4	3.6	5.4	26.4	22.7	.27	.39	2.58	11.2	41.1	7.6	6.9
1921	145.1	9.3	3.8	6.5	38.7	37.4	.58	.78	3.34	10.3	39.7	8.7	10.6
1922	125.5	10.0	2.5	7.4	33.6	42.4	.71	.96	4.17	9.0	39.8	6.3	8.4
1923	157.1	13.2	3.8	8.9	36.2	49.7	.69	1.64	3.70	8.8	35.2	6.0	4.2
1924	121.8	8.6	3.1	8.5	32.2	32.5	.79	1.58	3.86	7.7	35.3	7.1	5.4
1925	162.6	12.1	3.5	10.7	39.3	57.8	.93	2.16	6.08	11.2	40.0	9.2	4.6
1926	146.6	8.6	4.2	9.4	34.1	47.1	.92	1.86	5.02	11.2	38.9	8.0	8.0
1927	144.8	11.4	4.1	12.0	40.4	54.2	1.06	2.64	6.35	16.1	40.4	6.6	9.5
1928	129.6	6.6	4.3	12.1	41.4	53.9	.88	2.61	8.28	16.5	41.5	7.0	....
Average 1909–13	130.4	11.8[c]	3.3	12.8	37.9	63.7	.14	1.48	3.63	16.3[c]	32.0	6.3[a]	6.9
1922–26	142.7	10.5	3.4	9.0	35.1	45.9	.81	1.64	4.57	9.6	37.7	7.3	6.1

* Data of U.S. Department of Agriculture. For 1909–13, including U.S. Department of Agriculture estimates for area within post-war boundaries. Dots (....) indicate that data are not available.

[a] Four-year average.

[b] Regarded as too low by Soviet officials, whose estimate is 908 million bushels.

[c] One year only.

TABLE IV.—RYE PRODUCTION IN PRINCIPAL PRODUCING AREAS, 1920–28*

(*Million bushels*)

Year	United States	Canada	Argentina	Hungary	Bulgaria	Jugo-Slavia	Roumania	Soviet Russia	France	Germany	Italy	Belgium	Netherlands
1920	60.5	11.3	0.8	20.6	6.2	6.1	9.4	.....	34.5	194.2	4.5[a]	18.2	14.8
1921	61.7	21.5	1.7	23.2	6.1	6.2	9.1	.....	44.4	267.6	6.5	21.3	15.0
1922	103.4	32.4	3.5	25.1	6.4	4.5	9.2	.....	38.4	206.0	5.6	18.4	17.1
1923	63.1	23.2	4.0	31.3	5.2	5.9	9.6	.....	36.5	263.0	6.5	20.8	14.6
1924	65.5	13.8	1.5	22.1	4.3	5.5	6.0	737.0	40.2	225.6	6.1	20.7	15.6
1925	46.5	19.2	4.7	32.5	7.2	7.9	8.0	877.0	43.7	317.4	6.7	21.7	16.4
1926	40.8	12.2	3.3	31.4	7.1	7.5	11.2	901.6	30.1	252.2	6.5	20.1	13.6
1927	58.2	15.0	6.6	22.4	8.2	5.9	9.3	933.0	34.0	269.0	5.9	21.9	13.6
1928	41.8	14.6	...	32.5	9.0	8.6	11.8	783.4	35.4	303.3	6.5	27.7	17.0
Average													
1909–13	36.1	2.1	0.6	31.4	8.3	9.0	20.6[b]	735.5	52.5	368.3	6.3	23.6	16.4
1922–26	63.8	18.1	3.4	28.5	6.0	6.3	8.8	828.5[c]	37.8	252.8	6.3	20.3	15.5

Year	Denmark, Norway	Sweden	Spain	Portugal	Switzerland	Austria	Czecho-Slovakia	Poland	Finland	Latvia	Esthonia	Lithuania	Greece
1920	14.2	22.4	27.8	5.2	1.6	10.1	32.9	73.7	7.1	4.7	6.2	16.7	1.0
1921	13.2	26.6	28.1	4.6	1.6	13.2	53.7	167.6	11.7	9.8	5.9	21.0	1.1
1922	15.1	22.1	26.3	5.4	1.5	13.6	51.1	197.4	10.5	6.8	5.8	25.4	1.1
1923	15.9	23.4	28.1	5.2	1.6	15.8	53.3	234.7	9.4	10.8	6.5	23.8	0.6
1924	11.1	10.9	26.3	6.8	1.4	16.2	44.7	143.9	11.3	7.9	5.5	18.3	0.9
1925	14.4	26.6	29.9	4.6	1.6	21.7	58.1	257.2	13.7	12.4	7.2	26.1	1.6
1926	13.1	23.0	23.5	3.6	1.6	18.7	45.9	197.3	11.9	6.1	4.5	13.8	1.4
1927	11.0	18.7	26.5	4.7	1.6	20.1	49.3	223.9	12.9	10.2	6.7	21.2	2.4
1928	....	....	24.4	3.4	1.7	19.1	52.7	232.4	10.9	9.0	5.8	19.0	2.3
Average													
1909–13	20.1	24.1	27.6	2.3	1.8	23.8	63.5	218.9	10.5	13.1	8.1	24.3	1.1
1922–26	13.9	21.2	26.8	5.1	1.6	17.2	50.6	206.1	11.4	8.8	5.9	21.5	1.1

* See corresponding footnote under Table III.

[a] Old boundaries. [b] Four-year average. [c] Three-year average.

TABLE V.—POTATOES AND CORN PRODUCTION IN PRINCIPAL EUROPEAN PRODUCING AREAS, 1920–27*

(*Million bushels*)

Year	Potatoes							Corn (Maize)					
	British Isles	France	Germany	Belgium, Holland	Czecho-Slovakia	Poland	Soviet Russia[a]	Hungary	Bulgaria	Jugo-Slavia	Roumania	Soviet Russia[a]	Italy
1920	238	428	1,024	204	184	665	.....	50.2	20.9	101.1	182.0	.....	89.3
1921	245	305	961	179	159	617	.....	31.7	16.4	73.8	110.6	.....	92.3
1922	322	465	1,494	307	333	1,221	.....	48.7	16.4	89.8	119.8	.....	76.8
1923	221	364	1,197	211	229	973	.....	49.2	21.8	84.8	151.4	.....	89.2
1924	219	564	1,338	208	239	987	1,332	74.1	24.8	149.4	155.5	90.9	105.7
1925	281	558	1,533	230	276	1,069	1,541	88.0	25.8	149.2	163.7	176.6	110.0
1926	249	409	1,103	220	185	914	1,672	76.5	27.3	134.2	239.5	143.4	118.1
1927	275	644	1,380	214	335	1,167	2,009	68.3	20.6	84.3	139.1	148.8	83.9
Average													
1909–13	254	527	1,374	215	245	890	729	60.8	26.3	119.9	140.2	52.2	102.7
1922–26	258	472	1,333	235	252	1,033	1,515[b]	67.3	23.2	121.5	166.0	137.0[b]	100.0

* See corresponding footnote under Table III.

[a] European and Asiatic territory. [b] Three-year average.

TABLE VI.—UNITED STATES WHEAT ACREAGE, 1920–28*

(*Million acres*)

Crop of	Winter wheat			Spring wheat harvested	Total harvested
	Planted	Abandoned	Harvested		
1920.....	44.9	4.84	40.0	21.1	61.1
1921.....	45.6	2.21	43.4	20.3	63.7
1922.....	47.9	5.57	42.4	20.0	62.3
1923.....	46.1	6.58	39.5	20.2	59.7
1924.....	38.9	3.26	35.7	16.9	52.5
1925.....	39.8	8.61	31.2	21.0	52.3
1926.....	39.9	2.90	37.0	19.4	56.3
1927.....	43.6	5.58	37.7	21.1	58.8
1928.....	47.5	11.36	36.2	21.5	57.7
Average					
1909–13..	32.0	3.60	28.4	18.7	47.1
1922–26..	42.5	5.38	37.1	19.5	56.6

* Official data of U.S. Department of Agriculture. See especially *Agriculture Yearbook, 1927*, p. 743, and crop reports.

TABLE VII.—UNITED STATES WHEAT CROP FORECASTS AND ESTIMATES, 1926, 1927*

(*Million bushels*)

Date	1927 Bryant	1927 Cromwell	1927 Murray	1927 Snow	1927 Official	1928 Official
	WINTER WHEAT					
Apr. 1...	584	576	585	584	.....	.....
May 1...	600	597	603	589	593.9	479.1
June 1...	540	569	563	568	537.0	512.3
July 1...	546	558	576	565	579.4	543.8
Aug. 1...	528	558	562	555	552.8	578.6
Sept. 1...	528	558	547	555	552.8	578.6
Oct. 1...	528	558	547	555	552.8	578.6
Dec. 1[a]..	...	...	...	...	552.4[a]	579.0
	SPRING WHEAT					
June 1...	249	224	226	233	.....	.....
July 1...	278	241	254	256	274.2	256.2
Aug. 1...	274	288	300	309	298.4	312.7
Sept. 1...	284	281	286	294	308.1	322.5
Oct. 1...	288	290	288	300	313.8	325.3
Dec. 1[a]..	...	...	...	...	319.3[a]	323.8
	TOTAL WHEAT					
June 1...	789	793	789	801	.....	.....
July 1...	824	799	830	821	853.6	800.0
Aug. 1...	802	846	862	864	851.2	891.3
Sept. 1...	812	839	833	849	860.9	901.1
Oct. 1...	816	848	835	855	866.6	903.9
Dec. 1[a]..	...	...	...	...	871.7[a]	902.8

* Data from official and commercial crop reports and *Daily Market Record*, Minneapolis.

[a] The figures given are the revisions made as of December 1, 1927. The final estimates for the 1927 crop, published in December 1928, were as follows, in million bushels: 552.7, winter; 325.6, spring; 878.4, total.

TABLE VIII.—UNITED STATES WHEAT PRODUCTION BY GRADES, 1921–27*

(*Percentages of total crops*)

Crop of	No. 1	No. 2	No. 3	No. 4	No. 5	Other
	WINTER WHEAT					
1921.....	19.7	39.9	25.1	10.2	3.5	1.6
1922.....	13.3	38.0	27.6	13.1	5.2	2.8
1923.....	20.8	42.8	21.7	9.2	3.7	1.8
1924.....	30.3	42.8	16.8	6.7	2.3	1.1
1925.....	28.0	45.4	17.9	6.0	1.6	1.1
1926.....	49.6	33.6	11.5	3.1	1.5	0.7
1927.....	36.3	36.8	16.6	6.4	2.6	1.3
	SPRING WHEAT					
1921.....	24.1	25.6	24.2	15.1	7.9	3.1
1922.....	52.1	26.4	13.5	5.3	2.0	0.7
1923.....	18.8	26.4	24.1	16.3	8.8	5.6
1924.....	62.9	21.5	10.1	3.7	1.0	0.8
1925.....	37.5	28.0	18.8	9.2	4.8	1.7
1926.....	37.4	27.4	18.1	9.9	4.1	3.1
1927.....	46.2	24.8	15.4	7.5	3.7	2.4

* Data of U.S. Department of Agriculture: *Crops and Markets, Monthly Supplement*, December 1925, p. 403; *Crops and Markets*, March 1928, p. 81.

TABLE IX.—UNITED STATES WHEAT PRODUCTION BY CLASSES, 1920–28*

(*Million bushels*)

Crop of	Hard red spring	Durum	Hard red winter	Soft red winter	Pacific white	Total
1920.....	139	52	303	247	91	833
1921.....	131	57	290	238	99	815
1922.....	170	91	280	248	79	868
1923.....	126	56	242	272	102	797
1924.....	192	66	365	189	52	864
1925.....	156	65	206	170	80	676
1926.....	121	48	360	229	73	831
1927.....	202	83	317	181	95	878
1928.....	195	98	384	140	86	903

* Classification by U.S. Department of Agriculture. See especially *Agriculture Yearbooks*, and *Foreign News on Wheat: World Wheat Crop and Market Prospects*, December 22, 1928, p. 3. These are estimates only, and are made on a basis which does not lead to highly reliable results. Figures for 1928 are preliminary.

TABLE X.—UNITED STATES WINTER AND SPRING WHEAT ACREAGE, PRODUCTION, AND YIELD PER ACRE, 1920–28*

Year	Acreage (*Million acres*)		Production (*Million bushels*)		Yield per acre (*Bushels per acre*)	
	Winter	Spring	Winter	Spring	Winter	Spring
1920.....	40.02	21.13	610.6	222.4	15.3	10.5
1921.....	43.41	20.28	600.3	214.6	13.8	10.6
1922.....	42.36	19.96	586.9	280.7	13.8	14.1
1923.....	39.51	20.15	571.8	225.6	14.5	11.2
1924.....	35.66	16.88	592.3	272.2	16.6	16.1
1925.....	31.23	21.02	401.7	274.7	12.9	13.1
1926.....	36.99	19.35	627.4	203.6	17.0	10.5
1927.....	37.72	21.06	552.7	325.6	14.7	15.5
1928.....	36.18	21.54	579.0	323.8	16.0	15.0
Average 1922–26..	37.15	19.47	556.0	251.4	15.0	12.9

* Data of U.S. Department of Agriculture. See especially *Agriculture Yearbook 1927*, p. 743, and press releases.

TABLE XI.—CANADIAN WHEAT PRODUCTION FORECASTS AND ESTIMATES, 1923–28*

(*Million bushels*)

Date	1923	1924	1925	1926	1927	1928
June 30.....	366	319	365	349	325	...
July 31.....	383	282	375	317	357	...
Aug. 31.....	470	292	392	399	459	550
Oct. 31.....	470[a]	272	422	406	444	501
Dec. 31.....	474	262	411	410	440	...

* Canadian Dominion Bureau of Statistics, *Monthly Bulletin of Agricultural Statistics*, and press releases. See Appendix Table XXXI for evidence respecting apparent errors in crop estimates.

[a] September 30.

TABLE XII.—BROOMHALL'S FORECASTS OF EXPORTERS' SURPLUSES AND IMPORTERS' PURCHASES, 1927–28*

(*Million bushels*)

Date of report	Available for export	Margin over importers' purchases	Importers' purchases		
			Total	Europe	Ex-Europe
Sept. 6	852	104	748	608	140
Nov. 22	864	92	772	632	140
Dec. 20	900	128	772	632	140
Jan. 10	900	128	772	644	128
Apr. 17	900	108	792	664	128
June 12	901	104	797	669	128
July 17	917	120	797	669	128

* Data from Broomhall's *Corn Trade News*.

TABLE XIII.—UNITED STATES IMPORTS OF WHEAT AND FLOUR FROM CANADA, 1920–21 TO 1927–28*

(*Million bushels*)

Crop year July–June	Withdrawn for consumption, duty-paid	Withdrawn for milling in bond, free	General imports[a]		
			Wheat grain	Flour as wheat	Total
1920–21.....	.....[b]	.....[b]	51.00	6.39	57.39
1921–22.....	8.46[c]	6.17[d]	14.46	2.79	17.25
1922–23.....	7.41	9.28	18.01	1.93	19.94
1923–24.....	13.68	13.90	27.28	0.76	28.04
1924–25.....	0.27	5.81	6.17	0.03	6.20
1925–26.....	1.64	13.47	15.60	0.08	15.68
1926–27.....	0.05	13.17	13.24	0.03	13.27
1927–28.....	0.16	15.04	15.71	0.03	15.74

* Data of U.S. Department of Commerce, in part compiled from *Monthly Summary of Foreign Commerce*, and *Agriculture Yearbook, 1925*, p. 761; in part supplied direct.

[a] Practically all from Canada. No deduction made for re-exports, which rarely reach 1 million bushels.

[b] Distinction established by emergency tariff act effective May 28, 1921. Before this date no duties had been in force since April 17, 1917.

[c] Including June 1921.

[d] Nine months only (October–June).

TABLE XIV.—CANADIAN WHEAT AND FLOUR EXPORTS OVERSEAS, 1920–21 TO 1927–28*

(*Million bushels*)

Crop year Aug.–July	Total	Through U.S. ports	Through all Canadian ports	Through Vancouver alone
1920–21[a].....	112.3[a]	63.6[a]	48.7[a]	1.1[a]
1921–22.....	168.0	109.7	58.3	9.4[a]
1922–23.....	263.3	150.8	112.5	21.5[a]
1923–24.....	323.6	164.7	158.8	58.4[b]
1924–25.....	189.5	99.1	90.4	26.0
1925–26.....	314.0	161.3	152.7	58.7
1926–27.....	285.2	150.8	134.4	39.7
1927–28.....	324.5	151.5	173.0	85.7

* Official data from *Reports on the Grain Trade of Canada* and *Canadian Grain Statistics*. These figures do not include exports by lake and rail to the United States; hence the totals do not represent Canada's gross or net exports.

[a] September–August.

[b] Eleven months, September–July.

TABLE XV.—WHEAT RECEIPTS MONTHLY AT PRIMARY MARKETS IN THE UNITED STATES AND CANADA, FROM AUGUST 1924*

(*Million bushels*)

Month	United States primary markets				Fort William and Port Arthur				Vancouver			
	1924–25	1925–26	1926–27	1927–28	1924–25	1925–26	1926–27	1927–28	1924–25	1925–26	1926–27	1927–28
Aug.	93.0	43.3	71.6	81.6	1.3	1.2	1.5	2.4	.21	.55	.12	.09
Sept.	82.1	57.9	48.7	79.7	7.1	45.7	32.8	8.6	.41	.28	.29	.32
Oct.	88.0	36.1	37.1	73.3	40.9	53.2	56.1	51.4	3.98	7.04	6.37	6.17
Nov.	60.5	34.1	29.8	44.8	42.7	51.5	60.5	71.0	5.05	9.79	7.22	10.78
Aug.–Nov.	323.6	171.4	187.2	279.4	92.0	151.6	150.9	133.4	9.65	17.66	14.00	17.36
Dec.	36.3	34.9	22.4	26.5	20.3	53.5	26.3	41.0	4.21	6.14	6.63	11.81
Jan.	24.7	21.6	24.6	23.5	4.1	10.5	14.0	21.1	3.84	10.03	6.83	16.49
Feb.	19.9	16.2	21.0	22.5	6.2	4.0	8.6	9.5	2.08	7.74	4.27	12.54
Mar.	17.3	15.1	16.6	26.3	8.5	3.2	6.3	3.3	.74	6.98	5.94	10.50
Dec.–Mar.	98.2	87.8	84.6	98.8	39.1	71.2	55.2	74.9	10.87	30.89	23.67	51.34
Apr.	10.4	14.0	14.4	18.0	8.1	1.8	12.6	.9	1.02	3.58	3.58	10.88
May	17.6	15.7	19.2	25.9	7.0	17.2	17.3	17.6	1.54	1.20	1.57	7.43
June	21.9	21.0	20.7	15.6	4.1	13.6	7.3	20.1	.74	.22	.61	3.66
July	41.8	77.0	58.8	72.6	6.7	6.4	10.7	14.4	.11	.27	.14	2.44
Apr.–July	91.7	127.7	113.1	132.1	25.9	39.0	47.9	53.0	3.41	5.27	5.90	24.41
Aug.–July	513.5	386.9	384.9	510.3	157.0	261.8	254.0	261.3	23.93	53.82	43.56	93.11

* United States data are unofficial figures compiled from *Survey of Current Business;* Canadian data are official figures from *Reports on the Grain Trade of Canada* and *Canadian Grain Statistics.* Vancouver figures include receipts at Prince Rupert after October 1, 1926.

TABLE XVI.—INTERNATIONAL SHIPMENTS OF WHEAT AND RYE (BROOMHALL), ANNUALLY FROM 1920–21*

(*Million bushels*)

Crop year ending approximately August 1	Wheat, including wheat flour									Rye, including rye flour			
	North America	Argentina, Uruguay	Australia	Russia, Danube	India	Other	Total	To Europe	To Ex-Europe	North America	Russia, Danube	Other	Total
1920–21	432.2	63.9	82.1	1.6	11.2	....	591.0	541.5	49.5	40.0	1.3	1.7	43.0
1921–22	404.0	118.4	110.8	5.6	.2	8.1	647.1	546.7	100.4	34.9	.02	1.3	36.2
1922–23	455.2	138.3	47.8	6.9	26.1	2.1	676.4	585.9	90.5	58.7	2.7	1.5	62.9
1923–24[a]	454.4	174.4	77.9	36.0	17.5	15.1	775.3	626.5	148.8	26.8	41.3	....	68.1
1924–25	422.6	121.4	117.1	13.5	31.7	8.9	715.2	639.7	75.5	61.9	.4	.1	62.4
1925–26	413.2	93.9	74.0	32.7	4.9	48.8[b]	667.6	532.3	135.3	15.1	3.9	19.2[c]	38.2
1926–27	484.4	139.0	103.8	48.2	10.2	28.8[d]	814.4	682.4	132.0	32.5	8.1	6.6	47.2
1927–28	489.7	177.7	74.7	8.5	7.2	35.0[d]	792.8	661.8	131.0	35.1	10.0	15.1[c]	60.2
Average 1909–14	206.9	82.5	54.9	225.2	47.1	8.1	624.7	542.7	82.0	.9	24.3	28.8[c]	54.0
1922–27	445.8	133.4	84.1	27.5	18.1	20.7	729.8	613.4	116.4	39.0	11.3	5.5	55.8

* Data from *Corn Trade News.* Figures are Broomhall's cumulative totals, presumably revisions of his weekly shipment figures. The totals do not agree precisely with other figures of Broomhall's, particularly in 1924–25. Dots (....) indicate no shipments reported.

[a] For 53 weeks.
[b] Largely Germany and Poland.
[c] Chiefly Germany.
[d] Apparently includes some shipments from Danube countries.

TABLE XVII.—INTERNATIONAL TRADE IN WHEAT (INCLUDING FLOUR), ANNUALLY FROM 1920–21*

(*Million bushels*)

A.—NET EXPORTS

Crop year August–July	United States	Canada	India	Australia	Argentina	Chile	Hungary	Bulgaria	Jugo-Slavia	Roumania	Russia	Morocco
1920–21	307.9	165.8	15.1	88.9	64.0	2.2[a]	(.01)	1.77	3.76	1.41	.....	0.3[a]
1921–22	251.8	185.4	(13.8)	114.6	118.1	0.1[a]	9.40	4.52	3.90	3.51	.....	0.7[a]
1922–23	200.2	279.0	28.6	50.3	139.4	1.5[a]	5.15	4.32	1.01	1.64	.....	0.2[a]
1923–24	127.4	346.1	20.1	85.6	172.2	5.6	16.79	2.45	5.84	8.98	21.4[c]	1.7[a]
1924–25	256.4	192.1	38.1	123.6	123.1	7.7	13.54	(1.70)	9.55	3.21	....[b c]	0.7[a]
1925–26	103.4	324.1	8.0	77.2	94.4	1.0	19.79	4.37	11.59	9.93	27.1[c]	0.8[a]
1926–27	198.6	292.5	11.5	102.7	143.0	0.5[d]	21.88	2.25	9.74	11.20	49.2[c]	2.4[a]
1927–28	184.5	332.5	8.5	69.6	178.1	...	21.84	2.00[e]	1.16	7.50	7.0[c]	...
Average 1909–14	110.0	95.6	49.8	55.2	84.7	2.4[a]	43.14[f]	11.27[f]	.....	54.62[f]	164.5[f]	0.3[a]
1922–27	177.2	286.8	21.3	87.9	134.4	...	15.43	2.34	7.55	6.99	.....	1.1[a]

B.—NET IMPORTS

Crop year August–July	Algeria	Tunis	Egypt	United Kingdom	Irish Free St.	France	Germany	Italy	Belgium	Netherlands	Denmark	Norway
1920–21	5.6	1.3	11.21	200.1		68.3	59.8[g]	99.4	32.2	18.9	0.35	3.86
1921–22	(4.2)	(1.3)	6.84	208.2		17.1	69.5[g]	100.5	40.5	19.8	4.01	5.16
1922–23	2.3	0.7	7.68	205.5[h]	4.8[h]	45.6	37.5[g]	115.7	39.5	23.9	6.28	6.90
1923–24	(7.2)	(2.8)	8.52	219.4	20.3	53.3	30.7[g]	69.9	40.0	26.7	9.28	6.11
1924–25	0.5	(0.2)	9.90	208.8	19.1	58.5[i]	80.9[g]	88.7	39.0	26.8	6.55	5.57
1925–26	(4.6)	(2.6)	12.79	191.1	18.8	10.3[i]	57.4	67.9	39.2	27.2	6.00	6.70
1926–27	1.6	(0.3)	8.77	217.3	19.9	62.3[i]	91.8	86.6	39.5	28.5	7.24	6.22
1927–28	(5.3)	(0.6)	6.59	213.6	18.6	46.9[i]	88.5	89.6	41.9	31.0	10.97	6.78
Average 1909–14	(5.3)	0.8	8.32	217.7		43.6[f]	67.8[f]	53.0[f]	50.2[f]	22.6	6.66[f]	3.78
1922–27	(1.5)	(1.0)	9.53	209.1[j]	19.5[j]	46.0	59.7	85.7	39.5	26.6	7.07	6.30

B.—NET IMPORTS (*concluded*)

Crop year August–July	Sweden	Spain	Portugal	Switzerland	Austria	Czecho-Slovakia	Poland	Finland	Latvia	Esthonia	Greece	Japan
1920–21	6.61	19.83	6.6[a]	12.9	14.6	18.3	.....	2.47	0.58	0.61[a]	10.6	5.8
1921–22	3.85	8.02	8.1[a]	13.2	19.0	11.6	1.20	3.39	0.74	0.76[a]	13.7	24.9
1922–23	8.78	(0.18)	6.5[a]	16.6	13.4	10.2	2.52	5.12	1.11	1.18[a]	17.5	14.5
1923–24	12.35	(0.32)	3.2[a]	17.1	18.1	21.2	2.63	5.12	1.80	0.97	18.8	29.1
1924–25	10.58	0.80	5.5[a]	13.9	14.7[e]	21.5	17.10	4.54	1.94	0.86	20.8	12.2
1925–26	6.10	(0.73)	4.3[a]	15.6	14.7[e]	21.7	(4.60)	5.23	1.56	0.97	18.8	22.7
1926–27	6.02	(1.01)	...	16.3	16.9	20.1	8.07	5.14	1.68	0.91	18.1[e]	15.3
1927–28	8.42	(0.23)[k]	...	18.4	16.5	21.4	8.62	6.02	1.50	1.12	8.6[l]	16.3
Average 1909–14	7.07	6.19	3.0[a]	16.9	10.5[f]	....	.....	....	....	....	6.9[a]	4.1
1922–27	8.77	(0.29)	4.9[j]	15.9	15.6	18.9	5.14	5.04	1.62	.98	18.8	18.8

* Data from official sources, in large part through International Institute of Agriculture. Figures in parentheses represent, under *A*, net imports, and under *B*, net exports. Dots (....) indicate that data are unavailable or that comparable averages cannot be computed.

[a] Calendar years 1921 and following; averages for calendar years 1909–13 and 1923–27.

[b] Less than half a million bushels. Broomhall's shipments indicate imports of 9.4 million bushels.

[c] July–June figure.

[d] Gross figure.

[e] Eleven months.

[f] For pre-war boundaries; not comparable with post-war figures.

[g] Data incomplete because of territory occupied by foreign armies.

[h] Irish Free State separated after April 1, 1923.

[i] Statistics for 1924–25 and 1925–26 adjusted for imports of wheat under decree of December 30, 1924, permitting refund of duty. Figure for 1926–27 probably too low, for 1927–28 probably too high. For discussion see WHEAT STUDIES, II, 211 n., III, 427 n., and above, p. 80. From January 11, 1925, French shipments to the Saar region have not been counted as exports from France. These, consisting largely of flour, were 1.5 million bushels in 1922, 2.0 in 1923, and 3.2 in 1924.

[j] Four-year average.

[k] Eight months for wheat; seven months for flour.

[l] Six months.

TABLE XVIII.—INTERNATIONAL TRADE IN WHEAT FLOUR, ANNUALLY FROM 1920–21*

(Thousand barrels of 196 pounds)

A.—NET EXPORTS

Crop year August–July	United States	Canada	India	Australia	Argentina	Chile	Hungary	Bulgaria	Jugo-Slavia	Roumania
1920–21	13,665	6,688	835	2,281	353	138[a]	(2)	83	426	150
1921–22	14,900	7,701	497	3,677	950	100[a]	1,863	242	392	115
1922–23	14,457	10,936	538	4,081	842	151[a]	1,137	166	163	293
1923–24	17,020	11,933	708	5,222	1,772	181	2,333	147	417	936
1924–25	13,882	10,108	892	4,625	1,625	196	2,025	(23)	697	619
1925–26	9,551	10,847	685	5,008	1,648	48	1,817	465	456	849
1926–27	13,378	9,238	717	5,313	1,730	82[d]	1,588	336	311	983
1927–28	12,778	9,794	671	4,141	1,828	...	2,108	113[e]	46	441
Average 1909–14	10,639	3,898	613	1,802	1,307	67[a]	7,443[f]	502[f]	...	1,092[f]
1922–27	13,658	10,612	708	4,850	1,523	132	1,780	218	409	736

B.—NET IMPORTS

Crop year August–July	France	Italy	Belgium	Spain	Algeria	Tunis	Egypt	United Kingdom	Irish Free St.	Germany
1920–21	(66)	123	(2)	163	205	(4)	2,046	6,552	.....	306[g]
1921–22	(372)	(91)	(237)	(53)	(36)	20	1,478	7,559	.....	61[g]
1922–23	(478)	(393)	24	(43)	80	79	1,636	5,579[h]	607[h]	566[g]
1923–24	(254)	(1,493)	(480)	(66)	(62)	(34)	1,798	2,764	2,126	4,166[g]
1924–25	(393)	(1,246)	(787)	(59)	55	95	1,906	1,465	1,892	5,384[g]
1925–26	(260)	(334)	(151)	(157)	5	...[m]	2,436	2,483	1,748	1,411
1926–27	(28)	(195)	(64)	(218)	36	(24)	1,891	4,045	1,856	491
1927–28	125	(208)	(152)	(57)[n]	(92)	(9)	1,490	3,161	1,907	2
Average 1909–14	(133)[f]	(793)[f]	(704)	(12)	(126)	189	1,778	5,193		(1,827)[f]
1922–27	(283)	(732)	(292)	(109)	23	23	1,933	2,689[j]	1,905[j]	2,404

B.—NET IMPORTS (*concluded*)

Crop year August–July	Nether-lands	Denmark	Norway	Sweden	Austria	Czecho-Slovakia	Poland	Finland	Greece	Japan
1920–21	592	45	241	272	1,361	3,135	.....	432	229	157
1921–22	560	555	456	34	1,811	2,130	115	724	149	559
1922–23	659	555	603	75	2,016	1,996	535	1,091	1,099	147
1923–24	1,286	476	635	264	2,607	3,584	530	1,098	1,301	37
1924–25	698	201	560	146	1,580[c]	3,094	3,326	973	1,324	(518)
1925–26	1,269	495	775	(17)	1,279[c]	3,252	43	1,115	1,506	(1,016)
1926–27	1,751	690	611	76	1,763	1,691	76	1,098	1,152[e]	(591)
1927–28	2,008	829	754	136	1,821	2,106	84	1,289	271[i]	(1,002)
Average 1909–14	2,028	586[f]	639	87	.....	.....	.....	.....	92[a,f]	181
1922–27	1,133	483	637	109	1,849	2,723	902	1,075	1,276	(388)

* For footnotes see under Table XVII, except as follows: [m] Net import of 224 barrels. [n] Seven months.

TABLE XIX.—EXPORTS OF WHEAT AND FLOUR AS WHEAT FROM SPECIFIED EXPORTING COUNTRIES TO SPECIFIED IMPORTANT EX-EUROPEAN IMPORTING COUNTRIES, ANNUALLY FROM 1921–22*

(*Million bushels*)

A.—TO JAPAN FROM NORTH AMERICA AND AUSTRALIA

Year July–June	Wheat and flour			Total from			Wheat from			Flour from		
	Total	Wheat	Flour	United States	Canada	Australia	United States	Canada	Australia	United States	Canada	Australia
1921–22	25.39	21.85	3.54	13.96	3.62	7.81	11.00	3.35	7.50	2.96	.27	.31
1922–23	14.08	12.11	1.97	6.50	3.79	3.79	5.35	3.05	3.71	1.15	.74	.08
1923–24	32.12	30.29	1.83	11.06	7.25	13.81	10.26	6.96	13.07	.80	.29	.74
1924–25	14.89	14.55	.34	4.35	3.51	7.03	4.10	3.43	7.02	.25	.08	.01
1925–26	29.66	29.07	.59	5.28	13.48	10.90	5.18	13.03	10.86	.10	.45	.04
1926–27	19.97	19.27	.70	7.34	8.30	4.33	7.34	7.63	4.30	.00	.67	.03
1927–28	20.79	20.09	.70	6.30	11.25	3.24	6.30	10.59	3.20	.00	.66	.04

B.—TO CHINA, HONG KONG, AND KWANTUNG FROM NORTH AMERICA AND AUSTRALIA

Year July–June	Wheat and flour			Total from			Wheat from			Flour from		
	Total	Wheat	Flour	United States	Canada	Australia	United States	Canada	Australia	United States	Canada	Australia
1921–22	10.50	2.17	8.33	9.30	.37	.83	2.03	.00	.14	7.27	.37	.69
1922–23	16.97	1.95	15.02	13.73	2.88	.36	1.11	.80	.04	12.62	2.08	.32
1923–24	50.51	20.21	30.30	32.87	11.95	5.69	8.30	7.40	4.51	24.57	4.55	1.18
1924–25	5.66	.57	5.09	3.29	1.72	.65	.37	.20	.00	2.92	1.52	.65
1925–26	19.91	8.12	11.79	5.29	13.72	.90	.00	7.69	.43	5.29	6.03	.47
1926–27	13.23	4.24	8.99	6.06	6.96	.21	.30	3.94	.00	5.76	3.02	.21
1927–28	15.59	1.26	14.33	9.19	6.11	.29	.00	1.26	.00	9.19	4.85	.29

C.—TO BRAZIL FROM NORTH AMERICA AND ARGENTINA

Year July–June	Wheat and flour			Wheat and flour from		
	Total	Wheat	Flour	United States	Canada	Argentina
1921–22	.....	.....	....	....	....	.....
1922–23	18.38	13.63	4.75	2.24	.11	16.03
1923–24	21.93	15.53	6.40	2.49	.34	19.10
1924–25	20.50	13.16	7.34	3.24	.15	17.11
1925–26	21.94	13.52	8.42	4.06	1.00	16.88
1926–27	24.95	15.91	9.04	4.25	1.20	19.50
1927–28	31.80	22.91	8.89	4.10	.17	27.53

D.—TO EGYPT FROM NORTH AMERICA AND AUSTRALIA

Year July–June	Wheat and flour			Wheat and flour from		
	Total	Wheat[a]	Flour	United States[a]	Canada[a]	Australia[b]
1921–22	9.52	3.29	6.23	.89	.13	8.50
1922–23	8.15	.04	8.11	1.38	.63	6.14
1923–24	11.40	1.34	10.06	.61	.67	10.12
1924–25	11.56	1.89	9.67	.92	.46	10.18
1925–26	12.28	.67	11.61	1.44	.76	10.08
1926–27	15.83	4.62	11.21	1.58	.67	13.58
1927–28	13.68	4.96	8.72	.82	.62	12.24

E.—TO WEST INDIES FROM NORTH AMERICA

Year July–June	Total flour[c]	Flour from	
		United States	Canada
1921–22	11.18	8.18	3.00
1922–23	12.85	8.66	4.19
1923–24	14.40	9.76	4.64
1924–25	12.65	9.23	3.42
1925–26	12.77	8.24	4.53
1926–27	13.10	9.19	3.91
1927–28	13.19	8.93	4.26

F.—TO SOUTH AFRICA FROM CANADA AND AUSTRALIA

Year July–June	Wheat and flour			Total from		Wheat from		Flour from	
	Total	Wheat	Flour	Canada	Australia	Canada	Australia	Canada	Australia
1921–22	2.73	1.35	1.38	.20	2.53	.02	1.33	.18	1.20
1922–23	4.94	2.66	2.28	.51	4.43	.11	2.55	.40	1.88
1923–24	6.72	4.59	2.13	1.19	5.53	.87	3.72	.32	1.81
1924–25	5.60	4.09	1.51	.71	4.89	.42	3.67	.29	1.22
1925–26	4.70	3.37	1.33	.49	4.21	.25	3.12	.24	1.09
1926–27	3.58	2.36	1.22	.66	2.92	.35	2.01	.31	.91
1927–28	8.49	7.09	1.40	.84	7.65	.50	6.59	.34	1.06

* Data from official trade statistics of exporting countries. Exports from Argentina to Brazil in 1921–22 not available.

[a] Australia alone exports wheat to Egypt.

[b] Exports from Australia to Egypt and Sudan.

[c] Flour only, as wheat exports to the West Indies from these two countries never amounted to more than 150 thousand bushels during this period.

TABLE XX.—INTERNATIONAL TRADE IN WHEAT AND FLOUR, MONTHLY FROM JULY 1927*

(*Million bushels*)

A.—NET EXPORTS

Month	United States	Canada	India	Australia	Argentina	Roumania	Hungary	Jugo-Slavia	Poland	Algeria	Tunis	Egypt
July	11.6	8.6	5.12[a]	8.1	9.9	.56	1.26	.06	(.42)[b]	(.26)[b]	(.10)[b]	(.47)[b]
Aug.	27.5	14.5	1.57[a]	4.1	5.9	1.34	2.99	.23	(.08)[b]	.51	(.09)[b]	(.51)[b]
Sept.	39.1	17.1	.81[a]	4.2	5.4	1.88	3.28	.16	(.10)[b]	.26	(.18)[b]	(.56)[b]
Oct.	34.7	23.4	.74	2.3	5.3	1.14	2.57	.15	(.45)[b]	(.19)[b]	(.27)[b]	(.60)[b]
Nov.	24.8	57.9	.79[a]	1.6	5.0	1.24	2.26	.22	(.58)[b]	.56	(.02)[b]	(.64)[b]
Dec.	10.2	49.1	.35[a]	2.3	8.7	.95	1.71	.18	(.64)[b]	.16	.03	(.52)[b]
Jan.	11.1	18.6	.25[a]	9.3	24.1	.29	1.14	.00[c]	(.21)[b]	.34	.00[d]	(.57)[b]
Feb.	5.0	21.8	(.60)[b]	6.4	29.7	.16	1.46	(.09)[b]	(.09)[b]	.54	(.02)[b]	(.59)[b]
Mar.	5.8	23.7	.41[a]	9.1	31.6	.25	1.87	(.13)[b]	(.07)[b]	.52	(.04)[b]	(.60)[b]
Apr.	7.4	11.1	.48[a]	7.3	21.3	.12	1.42	(.16)[b]	(.47)[b]	.70	(.06)[b]	(.49)[b]
May	6.7	34.2	.68[a]	9.5	15.0	.02	1.54	(.12)[b]	(2.47)[b]	.65	(.11)[b]	(.66)[b]
June	7.1	25.2	2.50	8.6	16.6	.07	.96	(.05)[b]	(2.05)[b]	.63	.36	(.41)[b]
July	5.1	35.9	1.19[a]	5.0	9.6	.04	.62	.17	(1.41)[b]	.58	.96	(.44)[b]

B.—NET IMPORTS

Month	Irish Free St.	United Kingdom	France	Germany	Belgium	Italy	Netherlands	Scandinavia	Switzerland	Czecho-Slovakia	Baltic States[e]	Japan
July	1.70	17.33	10.00	10.19	3.62	7.59	2.02	2.06	1.43	1.56	.63	1.16[a]
Aug.	1.10	20.78	7.74	6.48	3.50	3.92	2.10	1.86	1.45	2.26	.57	.27[a]
Sept.	1.82	19.59	7.20	6.96	3.67	2.96	2.80	2.35	1.30	1.62	.70	.34[a]
Oct.	1.70	15.18	5.14	9.23	4.12	3.04	3.39	2.18	1.67	1.82	.78	.24
Nov.	2.24	19.13	5.33	8.96	3.60	4.86	3.60	2.45	2.05	1.80	.81	.89[a]
Dec.	1.93	15.74	3.93	8.06	3.62	6.19	2.96	2.89	1.80	2.83	.42	.89[a]
Jan.	1.34	13.97	3.02	7.84	3.02	7.45	2.30	1.77	2.28	1.35	1.16	1.90[a]
Feb.	1.55	14.85	2.80	6.11	2.95	6.98	2.02	1.89	1.59	1.30	.59	1.55
Mar.	1.54	23.61	2.13	6.99	3.94	9.33	2.96	2.39	1.68	2.12	.77	2.55[a]
Apr.	1.64	16.80	2.02	8.88	3.56	10.98	2.11	2.40	1.43	1.95	.70	2.33[a]
May	.50	17.03	1.82	6.88	2.62	13.74	2.19	2.26	1.05	1.98	.72	3.53[a]
June	1.64	17.59	2.47	6.00	3.64	9.60	2.86	1.94	.70	1.02	.77	1.38
July	1.37	19.36	3.26	6.96	3.68	8.57	1.71	1.78	1.41	1.33	.64	.63[a]

* Data from official sources and International Institute of Agriculture.

[a] Gross, not net.

[b] Net import.

[c] Net export of 500 bushels.

[d] Net export of 3,300 bushels.

[e] Finland, Esthonia, Latvia.

TABLE XXI.—UNITED STATES WHEAT AND FLOUR EXPORTS, ANNUALLY FROM 1920–21*

(*Thousand bushels*)

Crop year July–June	Wheat inspected for export						Unclassified wheat	Total wheat exports	Flour as wheat	Total exports	Total imports (less re-exports)	Net exports
	Hard red spring	Durum[a]	Hard red winter	Soft red winter	White (Pacific)	Mixed[b]						
1920–21	10,081	4,872	132,701	34,281	27,729	68,615	14,989	293,268	76,046	369,314	56,404	312,910
1921–22	20,145	8,697	78,477	18,998	43,652	18,963	19,389	208,321	74,245	282,566	16,852	265,714
1922–23	8,718	12,271	51,654	20,846	13,602	25,047	22,813	154,951	69,949	224,900	19,735	205,165
1923–24	1,022	4,908	19,640	9,810	18,653	5,435	19,325	78,793	81,087	159,880	27,954	131,926
1924–25	16,760	5,945	90,840	6,944	10,063	9,386	55,552	195,490	65,313	260,803	6,106	254,697
1925–26	3,338	4,170	7,358	2,282	16,914	5,944	23,183	63,189	44,846	108,035	15,363	92,672
1926–27	1,829	611	66,874	29,980	26,615	1,398	28,943	156,250	62,910	219,160	13,164	205,996
1927–28	5,209	3,496	41,603	9,915	28,150	1,874	55,752	145,999	60,729	206,728	15,711	191,017

* Data of U.S. Departments of Agriculture and Commerce. See especially *Agriculture Yearbook, 1924*, p. 579, and *1927*, p. 756; and *Crops and Markets* for 1926–27 and 1927–28 data.

[a] Durum exports are materially understated, in earlier years chiefly as explained in note *b*, in later years chiefly because inspections for export are limited to Atlantic, Gulf, and Pacific ports, so that large quantities of durum wheat that are exported from lake ports via Montreal escape classification.

[b] It was estimated that 20,030,000 bushels of durum were mixed with spring wheat in 1920–21. Other mixed wheat exports in 1920–21 were largely soft and hard winter wheat shipped through Gulf ports. In 1921–22 and 1922–23, 70 per cent of the exports of mixed wheat is estimated as durum. See *Agriculture Yearbook, 1924*, p. 578.

TABLE XXII.—OCEAN FREIGHT RATES ON WHEAT AND CORN, 1913 AND CROP YEARS 1921–22 TO 1926–27*

(*Cents per bushel*)

Period	Canada to United Kingdom	New York to Liverpool	Northern Range to United Kingdom	Northern Range to Genoa	Northern Pacific to United Kingdom	La Plata down river to United Kingdom	Karachi to United Kingdom	Australia to United Kingdom
1913 (Jan.–Dec.)	8.3	5.8	8.0	11.9	25.7	10.6	12.2	20.4
1921–22 (Aug.–July)	10.7	8.5	10.3	12.5	25.3	14.6	12.8	28.6
1922–23 (Aug.–July)	9.2	5.5	8.0	11.0	22.2	14.3	15.4	23.6
1923–24 (Aug.–July)	9.4	6.8	8.6	10.4	21.2	13.7	15.0	21.8
1924–25 (Aug.–July)	9.4	6.3	8.8	10.5	21.3	12.0	14.7	25.2
1925–26 (Aug.–July)	9.0	7.0	8.0	9.2	20.0	10.9	13.1	22.3
1926–27 (Aug.–July)	12.0	9.7	12.1	13.3	23.9	19.9	15.8	28.5
1927–28 (Aug.–July)	7.7	5.6	7.7	10.1[a]	19.5	13.9	13.2	23.2
1927 July	7.6	4.6	n.q.	8.6[b]	21.0	12.5	12.2	23.1
Aug.	8.5	4.9	n.q.	n.q.	21.2	15.2	12.8	21.8
Sept.	10.1	6.8	10.4	n.q.	22.1	13.5	13.9	24.7
Oct.	9.9	7.4	8.8	11.0[c]	21.4	12.8	13.5	25.1
Nov.	10.3	7.0	7.8	10.9	20.6	15.4	14.0	24.7
Dec.	6.4	5.8	7.2	9.7	20.3	15.6	14.1	24.5
1928 Jan.	6.1	5.5	6.9	9.4	20.1	14.4	14.0	22.7
Feb.	5.5	5.3	7.6	9.4[d]	19.7	11.9	13.4	20.6
Mar.	5.3	5.3	8.1	....	18.7	13.0	13.4	22.1
Apr.	5.3[b]	5.0	7.6	....	17.7	14.6	13.2	24.4
May	7.2[d]	4.6	7.2	....	17.3	13.9	13.1	23.3
June	7.3	4.5	6.9	....	17.3	12.8	12.4	22.9
July	8.4	4.6	6.8	....	17.6	13.8	11.2	21.8

* Averages of Friday rates published in *International Crop Report and Agricultural Statistics*. New York–Liverpool rates are for parcels in liners; others for cargoes.

[a] July–February. [b] One week only. [c] Three-week average. [d] Two-week average.

TABLE XXIII.—UNITED STATES AND CANADIAN CARRYOVERS OF WHEAT, 1919–28*

(*Thousand bushels*)

Year	United States (July 1)				Canada (August 31, 1919–23; July 31, 1924–28)				
	Total	On farms	In country mills and elevators	Commercial visible (Bradstreet's)	Total	On farms	In elevators	In transit	In flour mills
1919	49,806	19,261	19,672	10,873	.....[a]	2,149	3,305	.....[a]	.....[a]
1920	110,254	49,546	37,304	23,404	.....[a]	2,122	6,930	.....[a]	238
1921	93,840	56,707	27,167	9,966	13,727	2,144	4,831	6,032	720
1922	81,457	32,359	28,756	20,342	20,590	2,360	11,024	4,578	2,628
1923	102,414	35,894	37,117	29,403	11,690	1,441	5,051	2,758	2,440
1924	106,204	30,981	36,626	38,597	45,159[b]	7,363[b]	27,400[b]	5,856[b]	4,539[b]
1925	86,447	29,357	25,287	31,803	26,483	2,709	17,939	3,835	2,000
1926	65,949	20,973	28,490	16,486	35,601	3,987	25,451	3,163	3,000
1927	74,507	27,215	21,776	25,516	50,586	4,264	37,079	5,243	4,000
1928	84,514	23,450	18,856	42,208	76,484	4,186	53,570	13,728	5,000
Average 1910–14	89,411	32,485	31,600	25,326	.....[a]	.....[a]	.....[a]	.....[a]	.....[a]
1923–27	87,164	28,884	29,919	28,361					

* Bradstreet's visible, and official data of U.S. Department of Agriculture and Dominion Bureau of Statistics. See especially *Agriculture Yearbooks, Canada Yearbooks, Grain World*, and press releases.

[a] Not available.

[b] Total includes August 31 figure for stocks on farms, and July 31 figures for other items.

TABLE XXIV.—UNITED STATES CENSUS REPORTS ON CITY MILL STOCKS OF WHEAT AND FLOUR, 1925–28*

(*Million bushels*)

Date	U.S. flour output represented %	Wheat stocks in						Flour as wheat[c]	Grand total
		Country elevators	Public terminals	Private terminals[a]	Transit	Mills[b]	Total		
1925 June 30	87.4[d]	2.16	3.44		26.72		32.31	15.73	48.04
Dec. 31	88.0[d]	7.55	12.70		82.86		103.11	21.55	124.66
1926 Mar. 31	88.4[d]	4.67	7.10	3.65	3.29	45.93	64.64	18.28	82.92
June 30	87.4[d]	2.52	3.00	1.14	6.73	22.45	35.83	14.67	50.50
Sept. 30	87.4[d]	8.92	12.04	8.57	15.38	79.87	124.77	19.82	144.59
Dec. 31	87.5[d]	8.47	11.95	10.66	13.49	71.84	116.41	20.38	136.79
1927 Mar. 31	90.5[e]	6.06	6.85	5.84	6.45	60.57	85.77	19.40	105.17
June 30	90.1[e]	2.56	3.88	1.61	10.39	34.15	52.59	16.76	69.35
Sept. 30	89.1[e]	6.23	12.15	3.98	16.12	77.25	115.73	20.05	135.78
Dec. 31	89.5[e]	8.84	14.11	3.64	18.59	70.46	115.64	21.34	136.98
1928 Mar. 31	91.2[e]	5.48	9.33	2.11	9.41	59.05	85.38	19.69	105.07
June 30	90.4[e]	1.91	3.68	.55	10.16	29.78	46.08	17.08	63.16

* Data from press releases of U.S. Department of Commerce.

[a] In private terminal elevators not attached to mills.

[b] In mills and elevators attached to mills.

[c] Wheat-flour stocks in wheat equivalent (4.7 bu. = 1 bbl.).

[d] Based on total output (114,438,544 barrels) of wheat flour reported at the census of manufactures, 1923.

[e] Based on total output (114,689,930 barrels) of wheat flour reported at the census of manufactures, 1925.

TABLE XXV.—WORLD VISIBLE WHEAT SUPPLIES, AUGUST 1, 1920–28, AND MONTHLY, 1927–28*

(*Million bushels*)

Date	United States	Canada	Argentina	Australia	United Kingdom ports	Afloat to Europe	North America	Argentina, Australia	U.K. and afloat	Grand total	Total ex-Australia
1920 Aug. 1	42.7	8.2	3.7	27.5	12.8	76.2	50.9	31.2	89.0	171.1	143.6
1921 Aug. 1	56.2	8.9	3.7	30.0	7.6	57.9	65.1	33.7	65.5	164.3	134.3
1922 Aug. 1	43.1	19.3	2.2	3.0	7.1	48.9	62.4	5.2	56.0	123.6	120.6
1923 Aug. 1	73.3	14.1	4.4	18.0	8.2	39.0	87.4	22.4	47.2	157.0	139.0
1924 Aug. 1	72.1	31.6	6.8	30.0	9.9	41.8	103.7	36.8	51.7	192.2	162.2
1925 Aug. 1	57.3	23.4	7.7	8.4	9.2	33.3	80.7	16.1	42.5	139.3	130.9
1926 Aug. 1	64.2	28.3	4.1	6.2	4.3	38.6	92.5	10.3	42.9	145.7	139.5
1927 Aug. 1	65.9	42.7	5.9	12.7	7.8	46.1	108.6	18.6	53.9	181.1	168.3
Sept. 1	108.7	27.4	4.8	9.7	10.4	44.0	136.1	14.5	54.4	205.0	195.3
Oct. 1	143.7	22.2	4.4	6.8	10.0	50.0	165.9	11.2	60.0	237.1	230.3
Nov. 1	156.0	72.0	3.6	3.0	8.6	56.1	228.0	6.6	64.7	299.3	296.3
Dec. 1	154.7	120.9	3.6	.7	9.6	57.1	275.6	4.3	66.7	346.6	345.9
1928 Jan. 1	143.4	157.8	3.7	41.0	8.0	46.1	301.2	44.7	54.1	400.0	359.0
Feb. 1	128.9	162.8	8.0	51.0	6.4	65.5	291.7	59.0	71.9	422.6	371.6
Mar. 1	118.6	156.5	11.8	43.5	5.8	66.9	275.1	55.3	72.7	403.1	359.6
Apr. 1	110.1	146.6	12.8	36.0	7.7	68.4	256.7	48.8	76.1	381.6	345.6
May 1	97.8	131.1	11.0	24.5	9.8	65.7	228.9	35.5	75.5	339.9	315.4
June 1	75.1	107.3	9.9	26.0	10.1	55.0	182.4	35.9	65.1	283.4	257.4
July 1	61.1	95.6	7.7	19.5	10.4	50.2	156.7	27.2	60.6	244.5	225.0
Aug. 1	88.1	69.2	5.9	9.5	10.1	44.7	157.3	15.4	54.8	227.5	218.0
Average Aug. 1 1910–14	58.8	10.8	1.3	5.9[a]	15.4	35.2	69.6	7.2[a]	50.6	127.4[a]	121.5
1923–27	66.5	28.0	5.8	15.1	7.9	39.7	94.5	20.9	47.6	163.0	147.9

* A joint compilation by Broomhall, the *Daily Market Record*, Minneapolis, and the *Daily Trade Bulletin*, Chicago, here summarized from Broomhall's *Corn Trade News* and the *Daily Trade Bulletin*. Includes some flour stocks.

[a] For Australia, 4-year average, 1911–14.

TABLE XXVI.—UNITED STATES FLOUR PRODUCTION, NET EXPORTS AND SHIPMENTS, AND DOMESTIC DISAPPEARANCE, MONTHLY FROM JULY 1923*

(Thousand barrels)

Years	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
	A.—REPORTED PRODUCTION, IDENTICAL MILLS												
1923-24[a]	7,672	9,428	9,504	10,673	9,075	7,898	8,605	8,090	8,053	7,428	7,615	7,559	101,600
1924-25[b]	8,323	9,595	10,198	11,070	9,017	8,680	9,576	7,971	7,125	6,617	6,704	7,491	102,367
1925-26[c]	8,763	9,203	9,827	10,562	8,971	8,790	8,535	7,325	8,074	7,465	7,283	7,903	102,701
1926-27[d]	9,513	10,377	10,754	10,563	9,453	8,758	8,478	7,853	8,739	8,088	8,273	8,287	109,136
1927-28[d]	8,172	9,383	10,166	10,519	9,435	8,947	8,844	8,587	9,377	8,178	8,391	7,482	107,481
	B.—ESTIMATED PRODUCTION												
1923-24	9,048	11,239	11,284	12,667	10,558	9,311	10,063	9,454	9,387	8,633	8,871	8,749	119,264
1924-25	9,543	11,014	11,699	12,691	10,299	9,897	11,006	9,211	8,197	7,556	7,809	8,601	117,523
1925-26	9,806	10,413	11,126	12,000	10,190	9,976	9,521	8,180	9,068	8,301	8,099	8,709	115,389
1926-27	10,485	11,430	11,835	11,610	10,368	9,587	9,263	8,559	9,527	8,795	8,987	8,989	119,435
1927-28	8,850	10,179	11,033	11,411	10,199	9,646	9,519	9,222	10,084	8,744	8,967	7,948	115,802
	C.—NET EXPORTS AND SHIPMENTS TO POSSESSIONS												
1923-24	918	1,289	1,592	2,118	1,817	1,853	1,765	1,572	1,450	1,095	1,011	1,227	17,707
1924-25	831	993	1,511	1,909	1,653	1,510	1,060	976	1,425	1,012	746	859	14,485
1925-26	820	910	854	1,062	935	1,048	727	696	733	884	737	699	10,105
1926-27	848	1,403	1,617	1,429	1,400	1,270	1,084	905	929	1,062	1,162	914	14,023
1927-28	836	1,097	1,317	1,558	1,374	1,175	1,289	999	1,053	1,144	905	724	13,471
	D.—CALCULATED DOMESTIC DISSAPPEARANCE												
1923-24	8,130	9,950	9,692	10,549	8,741	7,458	8,298	7,882	7,937	7,538	7,860	7,522	101,557
1924-25	8,712	10,021	10,188	10,782	8,646	8,387	9,946	8,235	6,772	6,544	7,063	7,742	103,038
1925-26	8,986	9,503	10,272	10,938	9,255	8,928	8,794	7,484	8,335	7,417	7,362	8,010	105,284
1926-27	9,637	10,027	10,218	10,181	8,968	8,317	8,179	7,654	8,598	7,733	7,825	8,075	105,412
1927-28	8,014	9,082	9,716	9,853	8,825	8,471	8,230	8,223	9,031	7,600	8,062	7,224	102,331

* Reported production and trade data from U.S. Department of Commerce press releases, *Monthly Summary of Foreign Commerce*, and *Foodstuffs Round the World*. For an explanation of the estimated production figures see *Wheat Studies*, IV, 102.

[a] 955 mills. [b] 949 mills. [c] 975 mills. [d] 968 mills.

Table XXVII.—Average Prices of Representative Wheats in Leading Exporting and Importing Markets, Monthly, 1926–27*

(U.S. dollars per bushel)

Month	United States				Canada		Liverpool						Argentina	Australia
	No. 2 Red Winter (St. Louis)	No. 2 Hard Winter (Kansas City)	No. 1 Dark Northern (Minneapolis)	No. 2 Amber Durum (Minneapolis)	No. 1 Manitoba (Winnipeg)	No. 3 Manitoba (Winnipeg)	No. 1 Manitoba	No. 3 Manitoba	No. 2 Hard Winter	Pacific White	Australian	Argentine Rosafe	Barletta (Buenos Aires)	(Melbourne)
July	1.41	1.36	1.58	1.53	1.62	1.53	1.79	1.67	1.58	1.59	1.66	1.62	1.47	1.34
Aug.	1.42	1.35	1.50	1.40	1.60	1.45	1.79	1.66	1.55	1.58	1.63	1.63	1.47	1.36
Sept.	1.42	1.31	1.37	1.28	1.45	1.31	1.70	1.56	1.49	1.52	1.61	1.54	1.43	1.37
Oct.	1.45	1.28	1.34	1.23	1.44	1.27	1.66	1.54	1.48	1.47	1.57	1.52	1.40	1.39
Nov.	1.41	1.31	1.34	1.28	1.45	1.24	1.73	1.48	1.48	1.46[a]	1.56	1.50	1.39	1.34
Dec.	1.44	1.32	1.37	1.33	1.40	1.24	1.74[b]	1.51	1.51	1.50	1.58	1.50	1.32	1.31
Jan.	1.51	1.33	1.43	1.30	1.43	1.23	1.57[a]	1.51	1.51[a]	1.50	1.56	1.49	1.32	1.29
Feb.	1.56	1.33	1.42	1.29	1.42	1.24	1.59	1.49	1.50[b]	1.51	1.52	1.45	1.29	1.26
Mar.	1.69	1.38	1.47	1.33	1.48	1.30	1.64[a]	1.56	n.q.	1.60	1.60	1.49	1.32	1.32
Apr.	1.96	1.52	1.63	1.41	1.56	1.42	1.70[a]	1.61	1.62[c]	1.64	1.65	1.54	1.39	1.35
May	1.96	1.60	1.64	1.40	1.57	1.42	1.71	1.64	1.60[b]	1.64	1.67	1.60	1.44	1.38
June	1.79	1.47	1.53	1.31	1.43	1.30	1.64	1.48	n.q.	1.61	1.61	1.50	1.36	1.34
July	1.47	1.20	1.47	1.23	1.31	1.20	1.55	1.41	1.46	1.52	1.54	1.48	1.32	1.29

* United States prices are the U.S. Department of Agriculture monthly weighted averages of daily quotations for reported cash sales, compiled from *Crops and Markets*. Canadian prices are monthly averages of daily prices from *Canadian Grain Statistics*. Liverpool prices are averages of Friday quotations from *International Crop Report and Agricultural Statistics*, except Rosafé, No. 1 Manitoba, and No. 3 Manitoba at Liverpool which are averages of Tuesday quotations from Broomhall's *Corn Trade News*. Argentine prices are averages of daily prices from *Revista Semanal*. Australian prices are averages of weekly quotations for export wheat furnished directly by an Australian correspondent. No quotation is signified by "n.q."

[a] Three-week average. [b] One week. [c] Two-week average.

Table XXVIII.—Prices of Domestic Wheat in Europe, Monthly from August 1925*

(U.S. dollars per bushel)

Month	Great Britain			France (Chartres)			Italy (Milan)			Germany (Berlin)		
	1925–26	1926–27	1927–28	1925–26	1926–27	1927–28	1925–26	1926–27	1927–28	1925–26	1926–27	1927–28
Aug.	1.53	1.76	1.63	1.62	1.61	1.75	1.88	1.85	1.75[a]	1.55	1.75	1.78[b]
Sept.	1.48	1.46	1.43	1.57	1.77	1.57	1.94	2.03	1.73	1.38	1.71	1.68
Oct.	1.34	1.48	1.37	1.48	1.88	1.54	1.94	2.21	1.77	1.37	1.72	1.62
Nov.	1.45	1.62	1.32	1.37	1.96	1.48	1.99	2.20	1.90	1.49	1.78	1.57
Dec.	1.60	1.55	1.29	1.33	1.78	1.58	2.12	2.31	1.88	1.62	1.74	1.53
Jan.	1.60	1.55	1.29	1.39	1.88	1.58	2.17	2.13	1.93	1.61	1.72	1.52
Feb.	1.54	1.54	1.26	1.42	1.81	1.56	2.16	2.11	1.94	1.60	1.72	1.49
Mar.	1.51	1.52	1.27	1.39	1.70	1.65	2.14	2.11	2.00	1.66	1.73	1.59
Apr.	1.57	1.50	1.34	1.40	1.82	1.74	2.20	2.02	2.09	1.87	1.76	1.72
May	1.75	1.58	1.43	1.39	1.91	1.87	2.19	2.16	2.14	1.92[c]	1.92	1.73
June	1.77	1.65	1.43	1.52	1.88	1.85	2.20	1.99	2.10	n.q.	1.96[d]	1.66
July	1.84	1.64	1.41	1.53	1.81	1.76	1.98	1.80	1.77	n.q.	n.q.	1.60

* Data for Great Britain are averages of weekly average *Gazette* prices as given in the *Economist;* for France, averages of Saturday prices furnished directly by Federal Reserve Board; for Italy, averages of Friday prices of soft wheat as given in *International Crop Report and Agricultural Statistics;* for Germany, monthly average prices as given in *Wirtschaft und Statistik*. All data are converted, for convenience, from the domestic currency in which they are quoted in the above sources into U.S. money by monthly average exchange rates. No quotation is signified by "n.q."

[a] Three-week average.
[b] Second half of August.
[c] First half of May.
[d] First half of June.

TABLE XXIX.—APPARENT DOMESTIC UTILIZATION OF WHEAT (CARRYOVERS DISREGARDED), ANNUALLY FROM 1920–21*

(*Million bushels*)

Crop year August–July	United States	Canada	India	Australia	Argentina	Chile	Hungary	Bulgaria	Jugo-Slavia	Roumania	Morocco
1920–21	525.1	97.4	362.8	29.4[a]	90.2[a]	21.0[a]	37.9	28.1	39.2	59.9	17.9[b]
1921–22	563.1	115.5	264.2	44.0	45.4	23.6	43.3	24.7	47.9	75.0	22.9
1922–23	667.4	120.8	338.4	46.5	55.4	24.4	49.6	28.3	43.5	90.4	12.2
1923–24	670.0	128.1	352.3	42.7	77.6	20.9	50.9	26.7	55.2	93.1	19.9
1924–25	608.0	70.0	322.5	44.4	73.9	19.3	38.0	26.4	48.2	67.2	27.1
1925–26	573.0	71.4	323.0	39.3	108.9	25.6	51.9	37.0	67.1	94.8	23.2
1926–27	632.4	114.7	313.2	54.7	56.7	23.5	53.0	34.3	61.7	99.7	15.4
1927–28	693.9	107.5	326.5	....	....	....	55.1	45.2[c]	55.4	89.2	22.2
Average											
1909–14	580.1	101.5	302.1	35.9[a]	63.4[a]	19.0[a]	....	....	....	....	16.7[b]
1922–27	630.2	101.0	329.9	45.5[a]	74.5[a]	22.8[a]	48.7	30.5	55.1	89.0	19.6[b]

Crop year August–July	Algeria	Tunis	Egypt	British Isles	France	Germany	Italy	Belgium	Netherlands	Denmark	Norway	Sweden
1920–21	21.8	6.5	42.9	256.9	305.2	142.4[d]	240.7	42.4	24.9	7.7	4.9	16.9
1921–22	24.3	7.7	42.8	282.0	340.6	177.3[d]	294.6	55.0	28.3	15.2	6.1	16.2
1922–23	21.2	4.4	43.7	275.5	288.9	109.4[d]	277.3	50.3[e]	30.0	15.5	7.5	18.3
1923–24	28.6	7.1	49.2	298.2	328.9	137.2[d]	294.7	53.7[e]	33.0	18.1	6.7	23.4
1924–25	17.7	5.0	44.1	281.8	339.7	170.1[d]	258.8	52.4[e]	31.5	12.4	6.1	17.4
1925–26	28.2	9.1	49.0	263.6	341.1	175.6	308.7	54.2[e]	32.8	15.8	7.2	19.5
1926–27	25.2	12.7	46.0	289.3	294.0	187.2	307.2	53.0[e]	33.9	16.0	6.8	18.2
1927–28	23.1	7.7	50.9	289.4	323.0	209.1	285.4	58.9[e]	36.1	20.4	7.4	19.7
Average												
1909–14	29.8	7.0	42.5	277.3	361.2[f]	219.9[f]	236.3[f]	65.4	27.6	11.8[f]	4.1	15.2
1922–27	24.2	7.7	46.4	281.7	318.5	155.9	289.4	52.7	32.2	15.6	6.9	19.3

Crop year August–July	Spain	Portugal	Switzerland	Austria	Czecho-Slovakia	Poland	Finland	Latvia	Esthonia	Greece	Japan
1920–21	158.4	16.9[c]	16.5	20.0	44.7	....	2.7	.97	....	21.8	35.9
1921–22	153.1	17.4[c]	17.0	25.5	50.2	38.6	4.0	1.53	....	23.4	53.4
1922–23	125.3	16.5[c]	19.1	20.8	43.9	44.9	5.8	2.06	....	26.5	43.8
1923–24	156.8	16.4[c]	20.9	27.0	57.4	52.4	5.8	3.44	1.70	27.6	55.7
1924–25	122.6	14.1[c]	17.0	23.2	53.8	49.6	5.3	3.52	1.40	28.5	39.2
1925–26	161.9	16.4[c]	19.1	25.4	61.0	53.2	6.2	3.72	1.76	30.1	52.2
1926–27	145.6	15.1[c]	20.6	26.4	54.2	55.2	6.1	3.54	1.75	31.0[c]	43.8
1927–28	144.4[c]	15.4[c]	22.5	28.4	61.8	62.9	7.1	4.14	2.20	32.1[c]	47.6
Average											
1909–14	136.6	....	20.2	71.6[f]	....	....	...	....	....	....	29.2
1922–27	142.4	15.7	19.3	24.6	54.0	51.0	5.8	3.3	1.7[g]	28.7	46.9

* Computed from production and trade data given in Tables III and XVII. Dots (....) indicate that comparable production or trade figures are not available.

[a] Crop of 1920–21 minus exports of 1921, and similarly for other years. Averages are for calendar years 1910–14 and 1923–27.

[b] Crop of 1920 minus exports of 1920, and similarly for other years. Averages are for calendar years 1909–13 and 1922–26.

[c] Trade figures partially estimated.

[d] These figures are too low, as crops in earlier post-war years are underestimated and net imports, at least to 1924–25, are incomplete. See WHEAT STUDIES, December 1924, I, 17–18.

[e] Luxemburg included with Belgium after May 1922.

[f] Pre-war boundaries.

[g] Four-year average.

TABLE XXX.—AVERAGE DAILY VOLUME OF TRADING IN WHEAT FUTURES IN UNITED STATES MARKETS, MONTHLY FROM JANUARY 1921*

(*Million bushels*)

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Year
1920–21	....	....	....	....	....	....	39.1	44.1	39.5	52.5	46.1	49.8	45.2[a]
1921–22	45.5	39.6	57.1	54.0	53.7	43.3	36.5	67.9	61.3	48.9	37.4	41.8	48.7
1922–23	34.4	36.2	33.5	32.5	37.6	42.1	36.6	37.0	27.9	48.0	41.0	40.9	37.3
1923–24	32.3	31.4	28.3	30.2	27.1	21.1	14.3	18.1	22.8	18.0	14.4	34.0	24.3
1924–25	53.3	50.0	42.7	61.4	60.9	58.8	73.4	81.0	87.4	59.3	60.3	67.6	62.9
1925–26	56.2	60.0	59.0	60.4	65.2	90.3	60.6	58.3	69.0	55.8	48.8	46.3	60.9
1926–27	57.5	47.1	46.2	43.6	53.3	37.4	28.2	26.4	34.1	33.8	50.4	44.8	41.9
1927–28	40.7	42.4	36.9	36.7	34.9	20.9	15.4	22.1	34.2	66.2	56.6	36.2	37.0

* Data of Grain Futures Administration, U.S. Department of Agriculture. Not compiled prior to January 1921.

[a] Six-month average.

TABLE XXXI.—APPROXIMATE DISPOSITION OF WHEAT SUPPLIES IN FOUR LEADING EXPORTING COUNTRIES, 1923–24 TO 1927–28*

(*Million bushels*)

Item	United States (July–June)					Canada (August–July)				
	1923–24	1924–25	1925–26	1926–27	1927–28	1923–24	1924–25	1925–26	1926–27	1927–28
Initial stocks	151	165	135	111	138	29	41	26	35	48
New crop	797	864	676	831	878	474	262	395	407	440
Total supplies	948	1,029	811	942	1,016	503	303	421	442	488
Net exports	135	258	95	209	194	346	192	324	292	332
Seed requirements	79	84	82	88	94	39	38	40	39	41
Consumed for food	477	479	492	492	505	42	42	42	43	44
Unmerchantable, lost in cleaning, fed on farms	92	73	31	15	81	31	22	18	31	39
Apparent error in crop estimate						+4	—17	—38	—11	—43
Stocks at end	165	135	111	138	142	41	26	35	48	75
Total disappearance	948	1,029	811	942	1,016	503	303	421	442	488

* Based so far as possible upon official estimates for the various items of supply and disposition. It is necessary, however, to supply estimates for certain items in all four countries, as well as to adjust official figures in order to place all data on the designated crop year basis. The following notes explain our methods of estimation and adjustment.

UNITED STATES. *Initial stocks.* The figures for 1926–27 and 1927–28 (like the figure for stocks at the end of 1927–28) are sums of official estimates of stocks on farms and of stocks in country mills and elevators, Bradstreet's visible supplies, and wheat and flour stocks in city mills as reported by the Census Bureau. Flour stocks converted at 4.7 bushels per barrel. In order to avoid duplication with stocks in country mills and visibles, the quantities of wheat reported in "country elevators" and "in public terminal elevators" have been subtracted from the Census Bureau's totals. Published figures for country mill and elevator stocks on and prior to July 1, 1925, have been raised by 29 per cent, in accord with the Department of Agriculture's revision of the original estimate for July 1, 1926. In the absence of official data, city mill stocks on and prior to July 1, 1924, have been estimated roughly at 40 million bushels in 1923, and 50 million in 1924. Total initial stocks may be too low in 1923–24, too high in 1924–25; see WHEAT STUDIES, February 1928, IV, 169–70, 180. *New Crop.* Official figures. *Net exports.* Official data for domestic exports, plus re-exports, less imports. Includes shipments to possessions. Flour exports and re-exports converted at 4.7 bushels per barrel; flour imports (almost entirely from Canada) at the official Canadian figure, 4.5 bushels per barrel. *Seed requirements.* Official data. *Consumed for food.* Estimated directly on the basis of population estimates, assumed per capita consumption of flour of .9 barrel, and official data on milling ratios raised 1.5 per cent to account for small mills not reporting to the Census Bureau. *Unmerchantable and lost in cleaning; fed on farms; apparent error in crop estimate.* In the absence of official data on any of these items, the three must be bracketed and calculated as a residual. In our judgment the composite item so calculated is of reasonable size for 1923–24, 1924–25, and 1927–28, though perhaps slightly too high in each of these years. The low figures for 1925–26 and 1926–27 establish the presumption that the crops were officially underestimated in these two years; but numerical expression of the probable underestimates is not feasible in the absence of any dependable method of estimating the quantities of wheat fed and wasted annually.

CANADA. *Initial stocks.* Official data after August 1, 1924. The figures are slightly lower than official estimates of carryovers as shown in Appendix Table XXIII, apparently because certain quantities of wheat in transit are excluded from the former. The figure for August 1, 1923, is obtained by adding to official stocks figures as of September 1 the net exports and domestic consumption in August. *New crop.* Official data. *Net exports.* Official data. *Seed requirements.* Official data. *Consumed for food.* Official data except for 1927–28, which is estimated on the basis of increased population and a high milling ratio. *Unmerchantable, lost in cleaning, fed on farms.* Official data for the first two categories; we assume that wheat fed on farms is included in "unmerchantable." *Apparent error in crop estimate.* Calculated as a residual. The figures may be regarded as fairly reliable in view of the completeness of official disposition figures.

TABLE XXXI.—*Continued*

Item	Argentina (August–July)					Australia (August–July)				
	1923–24	1924–25	1925–26	1926–27	1927–28	1923–24	1924–25	1925–26	1926–27	1927–28
Initial stocks	65	66	56	61	65	42	38	36	30	41
New crop	248	191	191	221	239	125	165	115	161	110
Total supplies	313	257	247	282	304	167	203	151	191	151
Net exports	172	123	94	143	178	86	124	77	103	70
Seed requirements	21	23	25	24	25	11	11	11	12	14
Consumed for food	49	53	54	57	59	28	29	29	30	30
Feed and waste	3	2	10	6	3	4	3	4	5	4
Apparent error in crop estimate	+2	...	+3	—7	—31	...	...	...	...	...
Stocks at end	66	56	61	65	70	38	36	30	41	33
Total disappearance	313	257	247	282	304	167	203	151	191	151

ARGENTINA. *Initial stocks.* Figures for stocks on August 1, 1926 and 1928, calculated from direct estimates of stocks. See text, p. 66. Other stocks figures calculated on the assumption that stocks on January 1 remain constant at 10 million bushels, and that August 1 stocks must equal January 1 stocks plus net exports August–December, plus 5/12 of domestic consumption during the crop year. These estimates are tentative. *New crop.* Official data. *Net exports.* Official data. *Seed requirements.* Based on official data for acreage sown and average seed requirements per acre. The figure for 1925–26 has been made unusually high to allow for increased per acre requirements due to poor quality of seed. *Consumed for food.* Based on official data on flour milled less flour exported in calendar years, adjusted to present data for crop years. The figure for 1927–28 contains a considerable element of estimate, since data for the calendar year 1928 are not available. *Feed and waste.* Rough approximations based on the assumption that feed use of wheat is normally very small in a country exporting large quantities of corn, and introduced chiefly because relatively large quantities were probably fed and wasted in the calendar year 1926, following a crop of poor quality.

AUSTRALIA. *Initial stocks.* Calculated as residuals, on essentially the same assumptions as governed calculations of Argentine stocks. January 1 stocks of old-crop wheat are assumed to remain constant at 5 million bushels. *New crop.* Official data. *Net exports.* Official data. *Seed requirements.* Chiefly official data, but 1926–27 and 1927–28 figures are partially estimated. These figures include wheat sown for hay as well as for grain. *Consumed for food.* Based on official monthly data on flour production, less exports of flour. Figures for 1926–27 and 1927–28 estimated. *Feed and waste.* Based on official estimate of .5 to 1 bushel per capita utilization of wheat for feed, waste, and seed for green forage.

JAN 26

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 3 JANUARY 1929

SURVEY OF THE WHEAT SITUATION

AUGUST TO NOVEMBER, 1928

LOW and comparatively stable prices, heavy international trade, and exceptionally large stocks have characterized the world wheat situation in recent months. In international markets and exporting countries, prices have ranged considerably lower than in any year since 1923–24. Canada has exported unprecedented quantities, of old wheat and new; Argentine and Australian exports of old wheat have been relatively large; elsewhere exports have been light in proportion to the crops. Ex-European countries in particular have purchased liberally at low prices. Especially in Canada, but also in the United States, visible supplies have risen to extraordinary peaks.

This is a year of wheat surplus, roughly analogous to 1923–24. From a record acreage, high average yields were obtained. The world crop ex-Russia is about 3,750 million bushels, exceeding the best previous crops of 1915, 1923, and 1927. Except in Canada, Japan, and portions of other countries, the quality is generally good. Canada has a record crop; United States, Argentine, and Australian crops are among the best ever harvested; the Danube countries have the largest crops since the war. Without counting upon Russia and India, world export surpluses are unprecedentedly high. Net importing countries generally have at least fair wheat crops. Europe has good crops of rye, potatoes, oats, and barley, but the shortest corn crop since the war.

The international statistical position, therefore, is easy. But trends of seed requirements, population, and per capita consumption are upward, and low prices will encourage heavy utilization. Disappearance, international trade, and outward carryovers will probably all rise to new high levels. Total net exports may reach or exceed 900 million bushels, but United States exports bid fair to be small in proportion to the size of our crop.

STANFORD UNIVERSITY, CALIFORNIA

January 1929

WHEAT STUDIES

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Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.
Published by Stanford University for the Food Research Institute.

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STANFORD UNIVERSITY, CALIFORNIA

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The Food Research Institute was established at Stanford University in 1921 jointly by the Carnegie Corporation of New York and the Trustees of Leland Stanford Junior University, for research in the production, distribution, and consumption of food.

SURVEY OF THE WHEAT SITUATION

AUGUST TO NOVEMBER, 1928

Extraordinarily high visible supplies, and a relatively low level of wheat prices, were the outstanding features of the period under review. Except in certain continental European countries, wheat prices approached the previously lowest post-war level, that of 1923–24; and weighted average cash prices in the United States were about as low as in that year. After the sharp decline of May–July came to an end by the middle of August, prices fluctuated within narrow limits. Stability prevailed chiefly because a bumper crop in Canada was in prospect even as early as July, and because nothing occurred fundamentally to alter the general supply position.

Low prices reflect a record crop of wheat in the world (including or excluding Russia), so distributed as to result in an easy international statistical position. Table 1 (p. 114) summarizes world production in 1928 in comparison with earlier years, in figures which include our adjustments of standing official crop estimates. The wheat crop of 1928, ex-Russia, probably exceeds 3,750 million bushels, some 180 million more than in 1927 and 275 million more than in 1923, the two post-war years of largest crops. This year Canada, the Danube countries, and Russia have record post-war crops; the United States crop is the largest since 1919; and only India, Spain, Portugal, and Asia Minor have short crops. In Europe wheat is of better quality this year than last; but a record proportion of Canada's crop is grading below No. 3 Northern.

Import requirements at equivalent prices are larger this year than last, principally on account of the needs of Spain, Portugal, India, and certain other ex-European countries; but greatly increased exportable surpluses make for an easier international statistical position. The position is probably not so easy as in 1923–24, despite a much larger crop in 1928–29; for import requirements have grown rapidly over the interval of years.

With huge crops in North America, visible supplies have run extraordinarily high during August–November. Farmers in most countries have tended to market slowly because of low prices. International trade was of record volume for the period, especially the movement to ex-European destinations. Canada and Argentina, where inward carryovers were exceptionally large, exported record quantities; but the export movement from the United States was restricted, size of crop considered, by relatively high prices induced by heavy mill buying and a shortage of soft red winter wheat.

During the ensuing winter months, we anticipate a continuation of the low level of international wheat prices prevailing in October–December, with relatively small fluctuations; but seasonal movements usually occur, downward in the Southern Hemisphere, and upward in North America. Some pressure from the Southern Hemisphere crops perhaps remains to be felt; and no sudden and protracted increase in demand seems in prospect. The principal hope for higher international prices in the mid-winter months appears to lie in the possible emergence of Russia as an importer on a large scale; her heavy crop is poorly distributed geographically. When new-crop prospects come to exert their influence in the spring, rising prices are possible simply because such generally high average yields per acre as occurred in 1928 are statistically unlikely to occur in 1929.

We estimate the probable volume of international trade in wheat and flour for 1928–29 as about 900 million bushels, with an unusual proportion of the total passing to ex-European destinations. Canada and

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the Danube countries may make record exports, but the movement from the United States will probably prove small, size of crop considered. The carryover will probably be built up greatly in the United States, but there may be little change in Argentina and Australia, and possibly some decrease in Canada. Low prices promise to encourage heavy disappearance of wheat for food and feed throughout the world, more particularly in ex-European countries, and in the Danube basin, where the corn crop is short.

TABLE 1—WHEAT PRODUCTION IN PRINCIPAL PRODUCING AREAS, PRE-WAR AND POST-WAR*

(Million bushels)

Year	United States	Canada	Soviet Russia	Lower Danube[a]	Other Europe	North Africa	India	Japan, Chosen	Northern Hemisphere ex-Russia[b]	Argentina	Australia	Southern Hemisphere	World ex-Russia[b]
1920.....	833	263	...	172	774	71	378	41	2,550	156	146	350	2,900
1921.....	815	301	...	212	1,002	98	250	40	2,725	191	129	376	3,100
1922.....	868	400	...	224	815	71	367	40	2,800	196	109	354	3,155
1923.....	797	474	419	260	989	106	372	35	3,050	248	125	427	3,475
1924.....	864	*275*	472	204	846	85	361	35	*2,685*	191	165	407	*3,090*
1925.....	*700*	*430*	730	296	1,094	105	331	40	*3,010*	191	115	360[c]	*3,370*[c]
1926.....	*870*	*415*	820	294	910	90	325	39	*2,955*	221	161	435[c]	*3,390*[c]
1927.....	878	*475*	749	278	982	106	335	40	*3,110*	*275*	117	*460*[c]	*3,570*[c]
1928.....	903	*550*	860	364	1,020	106	290	42	*3,285*	*250*	*160*	*465*	*3,750*
Average 1909–13...	690	197	759[d]	330	1,017	93	352	32	2,725	147	90	280	3,004
1923–27...	*842*	*414*	638	266	964	98	345	38	*2,962*	*225*	136	*418*	3,379

* Summarized from most recent official data for individual countries (see Appendix Table I), as reported by the U.S. Department of Agriculture, but figures in italics represent our adjustments for apparent underestimates of crops, as shown in Appendix Table XI, for years prior to 1928. Italicized figures for 1928 represent our approximations, largely as explained in the text, pp. 115, 119. Totals exclude China, Asia Minor, Brazil, and a number of small producers. All estimates are for territory within post-war boundaries.

[a] Hungary, Bulgaria, Roumania, Jugo-Slavia.

[b] Rounded figures.

[c] Includes our estimate for Peru.

[d] Regarded as too low by Soviet officials, whose estimate is 908 million bushels.

I. CROP DEVELOPMENTS

The four months under review witnessed an exceptionally favorable season for late growth of wheat and harvesting in most countries of the Northern Hemisphere. In the United States and many countries of Europe, crop estimates were raised somewhat during August–November. But frosts during August did unexpected damage to the quality of Canadian wheat, and somewhat reduced the quantity. Early anticipations of huge crops in Argentina and Australia were not confirmed by later developments, especially in Australia; but both countries obtained crops well above average in size. In Europe, including or excluding Russia, and in the United States, the crops appear somewhat larger than they did four months ago, but such improvement is approximately counterbalanced by decreased expectations of outturns in the Southern Hemisphere and perhaps in Canada. On the whole, then, the world supply situation in mid-December is much the same as it appeared to be in mid-August. Large alterations in official Canadian and Russian estimates exerted surprisingly little market influence.

THE UNITED STATES

The United States clearly has a large crop of all types except soft red winter wheat. The official estimate of winter-wheat production remained, as usual, unaltered during August–November; that of the spring-wheat crop was raised from 312 million bushels as of August 1 to 323 million as of September 1, and again slightly to 325 million as of October 1.[1] Only negligible

[1] The course of official and private estimates of spring-wheat production, in million bushels, was as follows:

Date	Official	Bryant	Cromwell	Murray	Snow
Aug. 1	312	272	282	301	302
Sept. 1	323	310	314	319	325
Oct. 1	325	301	314	315	333
Dec. 1	324	...	...	...	...

changes were made in the estimate as of December 1. The standing estimate for the total crop, 903 million bushels, thus exceeds the estimate as of July 1 by 103 million bushels. The increase illustrates the importance of late growing and of harvesting weather in determining the size of the wheat crop. An even larger increase occurred in 1924; but such occurrences are uncommon.

According to official figures, the crop is the fourth largest ever harvested in the United States, smaller only than those of 1915, 1918, and 1919. Neither acreage harvested nor yield per acre was so exceptional as production. The harvested area of 57.72 million acres was exceeded in 8 of the preceding 62 years, and yield per acre of 15.6 bushels was equaled or exceeded in 7 of these, notably in 1914, 1915, and 1924. As earlier indications suggested, the crop of soft red winter wheat is the smallest in the nine years for which records are available, while that of durum is the largest in history.

Quality, always difficult to evaluate, appears on the whole average or better, but only the spring-sown bread wheat ranks above average by all the common tests. Weight per measured bushel of winter wheat is placed officially at 58.6 pounds, the same as in 1927 and slightly above the 10-year average of 58.2. But the official index number of winter-wheat quality, in which 100 indicates a high medium grade of wheat, is only 88.7 as compared with a 1918–27 average of 89.8 and 94.5 for the high-quality crop of 1926. There is much bleached grain and some bin-burnt grain in the Southwest, a result of heavy rains at harvest and wide use of the combine. Protein content of winter wheat, so far as can be judged by prevailing premiums, is about average, apparently higher than in 1927–28. Low-protein and bleached hard winter wheats are being employed as substitutes for soft red winter wheats to an unusual degree. Spring wheat averages 58.4 pounds per measured bushel as against 58.3 pounds in 1927 and a 10-year average of 57.2 pounds. The official estimate of spring-wheat quality, 89.6 for durum and 90.9 for other spring wheat, compares favorably with the 1918–27 average of 86.1 for the two varieties combined. Bread wheat in the Northwest appears to be of distinctly good quality, with good protein content, high test weight, high yield of flour per bushel of wheat, and comparative freedom from dockage; but amber durum of satisfactory milling qualities is hard to find.

Canada

Canada undoubtedly harvested the largest crop in her history in 1928; but opinions differ widely as to its precise size and as to its relative quality. The progress of the crop appeared to be distinctly favorable throughout June, July, and most of August. Frost was reported on August 13, and again on August 20–23, but these reports exerted comparatively little market influence, since the earlier frost was light and confined to restricted areas, while the later frosts came at a period when the crop as a whole was far advanced toward maturity. Aside from these frosts, weather was on the whole favorable both during the late growing season and during harvest, though hail did local damage and there were some heavy rains early in September.

The course of official and unofficial estimates of production in the Prairie Provinces were as follows, in million bushels:

Estimate	August 1	September 1	October 1	November 1
Official	...	527	...	480
Bryant	412	470	476	...
Cromwell ...	479	538	...	527
Murray	513	508	512	...
M.F.P.[a]	...	535	...	...
N.W.G.D.A.[b] .	...	...	558	...
Evans	...	...	...	547

[a] *Manitoba Free Press.*
[b] Northwest Grain Dealers' Association.

As these figures show, considerable differences of opinion regarding the size of the crop have prevailed since mid-summer. As a rule, the November estimates ought to approach the truth more closely than September or October estimates, since actual threshing returns can be used more extensively in determining average yield per acre, the factor which gives rise to most of the differences in production estimates. But this year the official estimate as of November 1, issued November 13, falls far below the three Canadian unofficial

estimates, those of the *Manitoba Free Press* (issued September 11), the Northwest Grain Dealers' Association (issued October 8), and the Sanford Evans Statistical Service (issued November 10). It is difficult to understand why the official figure is so low, especially by comparison with the two unofficial estimates issued in October and November, for the differences between them arise chiefly from differences in yields per acre reported by correspondents.[1] We are disposed provisionally to assume that of the three similar samples of yield per acre based on threshing returns, the two most closely in agreement—the Grain Dealers' and Evans' estimates—lie nearer to the truth than does the official estimate. A later (January 4, 1929) estimate by the Grain Dealers' was 441 million bushels. Official estimates in recent years, both as of November 1 and as of January 1 following, have understated the actual crop as judged by subsequent data on disposition.

Marketings in August–November, moreover, were extraordinarily large. One is not altogether justified in assuming that the large marketings necessarily imply a crop larger than that officially estimated, for favorable harvest weather and general enlargement of transport and terminal handling facilities made for relatively heavy marketings, and it is impossible to ascertain how far these factors, rather than the large crop, were responsible for the high figures. Nevertheless, if one reasons that receipts at the big terminal markets (Fort William and Port Arthur, Vancouver and Prince Rupert) in August–November are unlikely to have exceeded 45 per cent of the crop of the Prairie Provinces,[2] then the crop of this region in 1928 would seem to exceed 500 million bushels, and the total crop to exceed 520 million.

Altogether, on present evidence we are disposed to expect the total Canadian crop of 1928 to lie between 525 and 575 million, and we employ the round figure of 550 million in the belief that it is as reasonable an approximation as any. On any basis the crop of 1928 is the largest ever harvested in Canada; on this basis it is some 110 million bushels larger than that of 1927 if the official estimate for 1927 be employed, or some 75 million larger with a reasonable correction of the estimate of 1927. The largest previous crops, those of 1927 and 1923, were about 475 million bushels each.

Quality, however, at least so far as can be judged from grading, is poor as compared with earlier years. Table 2 illustrates the point. Much more wheat than usual has graded commercial Nos. 4, 5, 6, and feed, chiefly on account of the high proportion of green and frosted kernels. Conversely, the amounts of Nos. 1, 2, and 3 and of "no grade" (moist but otherwise Nos. 1–3 wheat) are in combination smaller than in any of the preceding years. But protein content of all grades, and weight per measured bushel as well, are relatively high.

TABLE 2.—PERCENTAGES OF VARIOUS GRADES OF CANADIAN HARD RED SPRING WHEAT TO TOTAL WHEAT INSPECTED IN THE WESTERN DIVISION, SEPTEMBER–NOVEMBER, 1923–28*

Grading	1923	1924	1925	1926	1927	1928
No. 1	40.2	22.8	28.4	14.1	1.7	1.1
No. 2	24.6	19.8	30.8	24.2	10.1	13.5
No. 3	20.5	19.1	13.7	9.3	24.2	20.1
No. 4	6.0	16.0	3.2	3.0	13.3	18.2
No. 5	1.8	7.7	0.8	1.1	4.6	15.5
No. 6	1.2	3.4	0.2	0.6	2.3	14.6
Feed	0.8	1.4	0.1	0.3	1.1	5.9
No grade[a]	1.1	7.2	17.8	38.4	36.1	1.8
Other[b]	3.8	2.6	5.0	9.0	6.6	9.3

* Data from *Canadian Grain Statistics.*

[a] Wheat grading Nos. 1, 2, and 3 except that it contains a higher proportion of moisture. Aside from higher moisture content, it may be of as good quality as these three grades, and is almost always better than grades Nos. 5 and 6, and feed.

[b] Largely durum.

A good deal of discussion has appeared regarding the milling and baking qualities

[1] The estimate of the Northwest Grain Dealers' Association, however, is based upon an estimate of area some 400,000 acres larger than the official estimate.

[2] Receipts at these points were 45, 42, and 45 per cent of the total crops of the Prairie Provinces (adjusted for underestimates) in 1922–23, 1925–26, and 1926–27, respectively, but only 37 and 33 per cent in 1923–24 and 1927–28 respectively. These are the only recent years in which the crops were sufficiently large to compare with the crop of 1928. If the August–November receipts this year should prove to be 45 per cent of the crop in the Prairie Provinces, the crop would be 507 million bushels. A similar calculation based on receipts at country elevators and platform loadings gives a higher figure, since unusual quantities of wheat remained in country and interior elevators this year.

of the lower grades especially.[1] It is beyond the scope of this survey to discuss in detail the varying opinions expressed. The evidence now suggests, however, that Nos. 4 and 5 are adaptable milling wheats—rather better than usual of the grade, indeed, because of high protein content and weight per measured bushel. There is more doubt about No. 6 and feed. Together they appear to constitute about 20 or 21 per cent of the crop of the Prairie Provinces, over 100 million bushels. It is interesting to speculate upon how much of this quantity will be employed for flour making, how much for feed; but at present precise measurement is hardly possible. Certainly a great deal of No. 6 wheat has already moved into export and has been milled in Canada into flour for export. Approximately 15 per cent of total receipts at Fort William and Port Arthur in August–November must have graded No. 6, or about 29 million bushels, while only 6.6 million bushels of this grade remained in terminal elevators at these points as of November 30; hence something like three-fourths of the receipts of this grade thus far may have found an export or eastern Canadian market.[2] Japanese and (in some countries) European millers can and have imported No. 6 wheat, and Canadian millers have found remunerative markets for straight flour milled from No. 6 wheat,[3] especially in view of high prices for mill offals. The great bulk of the lower grades of Canadian wheat must, in our opinion, be regarded as a part of the world's supply of bread grain, a part which must be reckoned with as affecting prices. Nevertheless an unusual quantity of Canadian wheat will be utilized as feed, both domestically and abroad.

[1] See especially a statement by F. J. Birchard and T. R. Aitken, chemists in charge of the Dominion grain research laboratory, reported in *Northwestern Miller,* October 24, 1928, which suggests that the lower grades including No. 6 are not far inferior to the higher grades in milling and baking qualities; a statement by Secretary Jardine of the United States Department of Agriculture, issued October 27, which states that a considerable proportion of wheat grading Nos. 5, 6, and feed "will not enter the market for good milling wheats," so that the official Canadian crop estimate may reasonably be scaled down by about 50 million bushels: and a statement by A. Cairns, statistician of the Canadian Pool, issued November 10, which states that No. 5 wheat is satisfactory, but that No. 6 and feed are so poor that "frost reduced the millable volume of Canada's 1928 wheat crop by many millions of bushels."

[2] These figures do not precisely reflect the situation, of course; for there may have been mixing of No. 6 with higher grades at terminal elevators.

[3] From experienced, large-scale millers in the United States, Canada, and Europe we have been able to secure reports on the milling of Nos. 5 and 6 commercial grades of Canadian spring wheat. Some spring-wheat mills are grinding No. 5 straight, others use equal parts of Nos. 5 and 6, others add one part of No. 5 to three parts of No. 6, and still others grind straight No. 6 wheat. The yields per bushel are low, from 5 bushels upward being required to produce the barrel of straight flour. The wheats are refractory to milling and the power consumption is high per barrel. The high price of millfeed has been a significant advantage in the transaction. The flours are dark in color, with high ash and high acidity, and are prone to decompose, especially the flour ground from No. 6. These flours are relatively high in protein content, but (largely on account of green kernels) the protein is of inferior quality in baking tests. The straight flour thus milled from Nos. 5 and 6 wheats is regarded as better than a second spring-wheat clear but not as good as a first spring-wheat clear flour. Apparently the North American mills do not ship such flour under mill brands into the European trade. Like clear spring-wheat flour in general, this flour is suited to the low grade Asiatic and Mediterranean market, but would not keep well enough for the South American market. The flour is peculiarly adapted, as of quality, to the Asiatic trade; its defects stand out most sharply when it is used straight for making yeast-risen bread, and are of little account when it is used for making noodles, dumplings, or steam bread. To a small extent Nos. 5 and 6 wheat can be mixed with high-grade spring wheat to make mill brand flour, under heavy bleaching. Skilfully blended with other wheats in the manufacture of flour in Europe, No. 5 Canadian wheat is apparently finding extensive use. One large European miller informs us that No. 5 wheat, when purchased at the head of the lakes under personal inspection of his representative, for purposes of blending is being found equal or superior to No. 3 wheat of the crop of 1927, as judged on the basis of price. From the available information it is becoming clear that Nos. 5 and 6, and even feed grade, wheat is to be regarded as a part of the millable Canadian crop, and is passing into consumption as foodstuff to a much greater extent than as feeding stuff.

Europe

Most countries of Europe (ex-Russia) were favored by unusually dry weather in the later stages of wheat growth and at harvest, though the drought proved detrimental to wheat in Spain and Portugal, and to corn generally. By the end of November official and unofficial crop estimates in many countries were higher than those standing in mid-August, the most noteworthy increases being in France and Germany. Total increases more than offset decreases, which were largest in Spain and Italy. In sharp contrast with last year, practically all European countries harvested wheat crops of good quality in 1928. Rye

crops also turned out larger than was earlier anticipated, and proved of good quality.

There are eleven European countries which ordinarily produce more than 20 million bushels of wheat. Of these, six—Hungary, Bulgaria, Jugo-Slavia, Roumania, Czecho-Slovakia, and Germany — secured in 1928 the largest crops of post-war years. Of the remaining five, Italy appears to have harvested a larger crop only in 1925, while the Polish crop was larger in 1925 and 1927. France had larger crops in 1921, 1924, and 1925. The crop of the British Isles was the smallest in post-war years on account of a reduced acreage, while that of Spain was smaller than any except those of 1922 and 1924, the result of low yield per acre. Among the smaller producers, Belgium, Holland, Switzerland, Austria, Lithuania, and Greece have record crops for post-war years, and only Portugal has a distinctly small one. These generally excellent outturns were obtained despite an unfavorable winter and a late and cold spring; not until July, in fact, did European crop prospects become distinctly good.

Production is more notably large in the four exporting countries of the Danube basin than elsewhere in Europe. Standing estimates for these countries total 364 million bushels, nearly 70 million more than in 1925, when the previously largest crop was harvested. Some reduction is possible; an earlier Roumanian estimate has already been reduced by 15 million bushels, and the standing Jugo-Slavian estimate, based upon a yield per acre 29 per cent larger than in any of the preceding eight years, looks rather high.

The crop of Europe outside Russia and the Danube countries approximates 1,020 million bushels, somewhat above those of 1921, 1923, and 1927, but 74 million below the big crop of 1925. The chief difference between 1928 and 1925 is the smaller crops in France and in Spain, which totaled 493 million bushels in 1925 but only 407 million in 1928. In Europe, exclusive of Russia and the Danube countries, the crop of 1928 exceeds that of 1927 by around 38 million bushels according to present estimates, but by less if the French crop of 1927 was in fact underestimated, as many observers believe. These two crops differed little in distribution, though Italy and Germany especially have larger outturns this year, while the British Isles, Spain, and Portugal have smaller ones. European crops of millable wheat, however, are larger than last year's to a greater extent than crop figures suggest, for the crop of 1927 contained considerably more unmillable grain.

Table 3 shows European (ex-Russian) crops of wheat, rye, potatoes, and the feed grains for the past nine years. The European rye crop of 1928, like the wheat crop, is larger than any except that of 1925; it exceeds the crop of 1927 by over 90 million bushels, and is of much better quality. The potato crop also is distinctly large, though complete statistics are not available. The barley crop is the largest in nine years, and so also is the European crop of oats. But the corn crop was seriously reduced by the dry weather which proved so favorable to wheat harvesting, and is the shortest since the war. All countries obtained poor corn yields, but Roumania and Italy suffered most. European gross supplies of bread grains and potatoes seem larger, on the whole, than in any post-war year except 1925. The combined supplies of feed grains, while large, are relatively less ample, in view of the larger count of animals; in terms of weight, larger crops were secured in 1925 and 1926.

TABLE 3.—EUROPEAN (EX-RUSSIA) CEREAL AND POTATO CROPS, 1920–28*

(*Million bushels*)

Year	Wheat	Rye	Potatoes	Corn	Barley	Oats
1920	946	533	3,351	520	551	1,478
1921	1,215	758	3,078	393	566	1,509
1922	1,038	713	4,803	423	599	1,544
1923	1,249	823	3,864	467	663	1,756
1924	1,050	651	4,201	590	577	1,628
1925	1,390	937	4,745	622	691	1,792
1926	1,204	745	3,840	667	689	1,922
1927	1,260	800	4,735	482	680	1,843
1928	1,384	894	.....	380	746	1,934
Average 1909–13 .	1,347	977	4,162	528	701	1,931
1923–27 .	1,231	791	4,277	566	660	1,788

* Summarized from most recent official data for individual countries, as reported by the U.S. Department of Agriculture. Excludes a few minor European producers. Pre-war averages are estimates for territory within present boundaries, and include 2-year or 4-year averages for a few countries.

The Russian wheat crop, earlier placed at 750 million bushels, is now officially estimated at 860 million bushels, the largest crop since the war—40 million above the large crop of 1926 and 110 million above the crop of 1927. Production is said to be heavy in the northerly spring-wheat regions, but deficient in the winter-wheat regions adjacent to the Black Sea. Much grain was damaged by wet harvesting weather in the spring-wheat regions. The rye crop is estimated as 783 million bushels, the smallest in four years and 150 million below the excellent crop of 1927. Considering these facts, and difficulties encountered in collecting and transporting grain, together with rapid growth in consumption of wheat, the possibility of appreciable exports of wheat from Russia now appears remote.

The Southern Hemisphere

In both Argentina and Australia the seeding season was favorable, with ample supplies of subsoil moisture. In both countries record areas were sown, in continuation of upward trends. The latest official figures are 14.0 million acres in Australia, 20.9 million in Argentina—an increase over 1927 of more than 5 per cent in Argentina, and nearly 20 per cent in Australia.

Early progress was favorable in Australia; but in August and September the rainfall was exceptionally scanty, and by mid-September a crop failure seemed imminent on late-sown fields in many regions. In South Australia at least, rainfall during the first three weeks in August was the shortest in eighty-nine years. But heavy rains in late September "saved nine out of ten crops from partial or total failure."[1] October was an abnormally rainy month, and benefited the crop further. Early in August, before the drought had progressed far, observers were anticipating a record Australian crop; many considered 200 million bushels a reasonable forecast. The first official forecast, issued in November, however, placed the probable outturn at 154 million, though unofficial observers tended to increase their estimates as harvest progressed in November and December. At 154 million bushels, the crop is above average in size, the largest since the war except those of 1924 and 1926, and 37 million larger than that of 1927.

In Argentina, weather conditions appear to have been distinctly favorable except for dry weather in the region centering around Bahia Blanca in the southern portion of the wheat-growing area, though toward the end of November there were complaints that rain was hindering harvest in the northern regions. Precipitation was subnormal from June to the end of November, especially in the southern districts; but a comparatively dry winter is said to favor the growth of wheat in Argentina. On November 12, the *Times of Argentina,* usually a reliable authority, stated that "conditions throughout 90 per cent of the wheat and linseed area are magnificent." All told, reports from various sources have consistently suggested a distinctly large crop. In earlier months the large acreage alone indicated a large crop if yield per acre proved only average. On November 21 the United States Department of Agriculture forecast the crop at 230 million bushels (plus or minus 19 million) on the basis of an analysis of weather conditions in relation to yield per acre in past years. The reports emanating from Argentina suggested that this figure might prove too low.

The usual official December forecast was not issued this year. We employ a figure of 250 million bushels, and regard it as conservative in the light of recent advices. On this basis the crop is the largest ever harvested, except perhaps for that of 1927, which was officially placed at 239 million bushels but seems actually to have been some 30 million larger.

II. MARKETING AND STOCKS

Largely as a result of the exceptional crops, coupled with large inward carryovers, stocks of wheat in North America attained and maintained unprecedented size during August–November. Marketings by farmers may have been somewhat curtailed in the United States, but restraint in exporting was a larger factor in keeping visible

[1] *Wheat and Grain Review* (Melbourne), October 6, 1928.

supplies high. In Canada the movement from farms, favored by good weather for threshing, was the heaviest in history; and the export movement, though rapid, was not rapid enough to prevent great accumulation of supplies. In Europe the new crop moved from farms rather slowly, in part because farmers were dissatisfied with prevailing prices. European stocks of import wheat appear not to have accumulated in ports, despite heavy importations, but they probably ran high in other channels. Argentine supplies of old-crop wheat remained high. All told, wheat and flour stocks throughout the world stood at a relatively high level on December 1 because of the large crop of 1928 and the high carryover at the end of the preceding crop year. Wheat has doubtless been consumed in greater volume than usual, but not rapidly enough to prevent exceptional accumulations. The quantity of wheat held by farmers is probably somewhat larger than usual, but the striking increase has been in visible supplies.

European Marketing

Precise comparisons of rates of marketing from farms in various European countries cannot be made for lack of statistics. This year, however, trade reports have almost consistently mentioned the general tendency of farmers to restrict sales in the hope of obtaining higher prices later. The tendency has perhaps been most noteworthy in France, where millers, at least during many weeks in the earlier part of the period, found import wheats offered more cheaply and more plentifully than domestic wheats. In England, farmers' deliveries during August–November totaled 7,399 thousand bushels, a considerably smaller amount than in 1925 and 1926 when higher prices prevailed, but larger than in 1924 and 1927, when crops were late and contained much damp grain. In Germany, the percentage of the total winter-wheat crop remaining on farms on September 15 and intended for sale was 75.2 per cent, as compared with 71.0 per cent last year. Farmers in southern Italy appear to have chosen to store much of their wheat. In several other countries a tendency to market somewhat slowly, though by no means with marked reluctance, has been observed.

The situation was peculiar in the Danube countries, especially Roumania and Hungary. Here early marketings after harvest were light. Later, however, as wheat prices, influenced by high prices for corn, stood higher than in world markets, marketings became more liberal. Thereupon large stocks of wheat seem to have accumulated at terminal markets, since wheat could not be exported freely while domestic prices remained relatively high. In Russia the collecting campaign was distinctly unsatisfactory in August, when grain was sought in the southern districts where crops were short; but September and October collections, largely from more northerly areas, compared favorably with those of 1927. Less grain has been collected than in 1926, when the largest exports of post-war years were made.

North American Marketing

For the United States as a whole, there is no altogether satisfactory measure of the seasonal movement of grain from farms to market. Receipts at primary markets[1] during July–November, 358 million bushels, were the largest in eight years except 1924, and Murray estimates, on the basis of returns from correspondents, that 69.0 per cent of the "marketable" supply of wheat had moved from farms by December 1, as compared with 72.7 per cent in 1927 and a "normal" of 67.1 per cent. But statistics of receipts at primary markets are likely to be misleading, for three principal reasons: first, a much larger proportion of the spring-wheat than of the winter-wheat crop is normally sent to "primary markets"; second, wheat moving direct to Gulf ports and to Pacific ports escapes recording; and third, a variable part of the wheat shipped to terminals remains the property of the farmer-shipper. All of these factors have made for heavy receipts this year, without necessarily indicating rapid *sale* from the farms. In particular the export movement from Gulf and Pacific ports has been relatively small, size of tributary crops consid-

[1] See Appendix Table III.

ered; and an unusually large amount of this wheat has been moved to central terminal markets, thus swelling the figures for receipts.

All reports from the Pacific Northwest indicate that an unusual proportion of the crop remains on farms: although mills have bought heavily and some wheat has moved eastward by rail, exports have been exceptionally small, size of crop considered. In the hard spring-wheat belt, as may be judged with some accuracy by receipts at Duluth and Minneapolis, wheat has flowed freely to terminal markets, though not so freely as in 1927; but large numbers of farmers have taken storage tickets rather than cash payment, thus reserving the privilege of naming the date at which they choose to receive payment at the price on the day chosen. Much of the wheat received at country elevators has been moved forward by elevator operators under the protection of a hedge; but in the merchandising sense if not in the physical sense farmers are holding their grain. The situation is less clear in the central and southwestern states; here, apparently, marketing has been relatively more liberal, but probably not so liberal as statistics of receipts would seem to indicate. Non-statistical evidence thus suggests that, for the United States as a whole, farmers have been inclined to heed Secretary Jardine's advice,[1] or on their own initiative, to hold their wheat in order to obtain higher prices; but the tendency has not been strikingly pronounced.

Increasing use of the combined harvester-thresher apparently led to an early movement to terminal markets in the hard wheat belt—earlier than in any recent year except 1926–27. Of the quantity of wheat still on farms in this area, much is said to be binburnt as a result of combine harvesting of grain with high moisture content. In the hard spring-wheat belt, however, the early movement (late August and early September) was slightly delayed by rainy weather.

Canadian wheat moved from farms to market in exceptional volume during August–November. Receipts at country elevators in the Prairie Provinces totaled 334 million bushels during the period, 26 per cent more than in any similar period of the past six years, and 116 million bushels, or 53 per cent, more than in 1927, when the late and rainy harvest period delayed the movement. Receipts at Fort William and Port Arthur totaled 197 million bushels as against the previous record figure of 170 million in 1923; and receipts of 31 million bushels at Vancouver and Prince Rupert were over 13 million larger than in any other year.[2] These huge receipts were of course in large part the result of the huge crop, but were due in part to exceptionally favorable harvesting weather and to increased facilities for transportation and storage. The movement from farms became large much earlier than in 1927 and somewhat earlier than in 1926, years when rain caused exceptional delay; but the weather appears not to have been more favorable in 1928 than in several earlier years.

Visible Supplies

Exceptionally high visible supplies of wheat have constituted one of the most notable features of the period under review. Chart 1 (p. 122) summarizes visibles in the United States, Canada, and afloat for Europe and in ports of the United Kingdom. Comparisons are shown with earlier years of exceptionally high visibles — 1923–24, 1926–27, and 1927–28.

In the United States, the crop year began with relatively high visibles, largely as a result of restricted exportation during the latter half of 1927–28. The large crop, continued restriction of exports, and heavy receipts at terminal markets combined to cause the most rapid increase in visibles witnessed in many years, despite the fact that domestic milling demand was heavy and that mills accumulated more wheat than usual in their own storage elevators, thus removing it from the commercial visible. By the end of October visible supplies alone totaled 142 million bushels, nearly 45 million more than in 1927, previously the record post-war year; and approximately this level was maintained throughout November.

[1] See press releases of the U.S. Department of Agriculture, August 23, September 12, and October 27, 1928.

[2] See Appendix Table III.

At the end of November the increase in visible supplies over 1927 was distributed as follows among the principal points of accumulation, according to data of the Chicago Board of Trade, in thousand bushels:

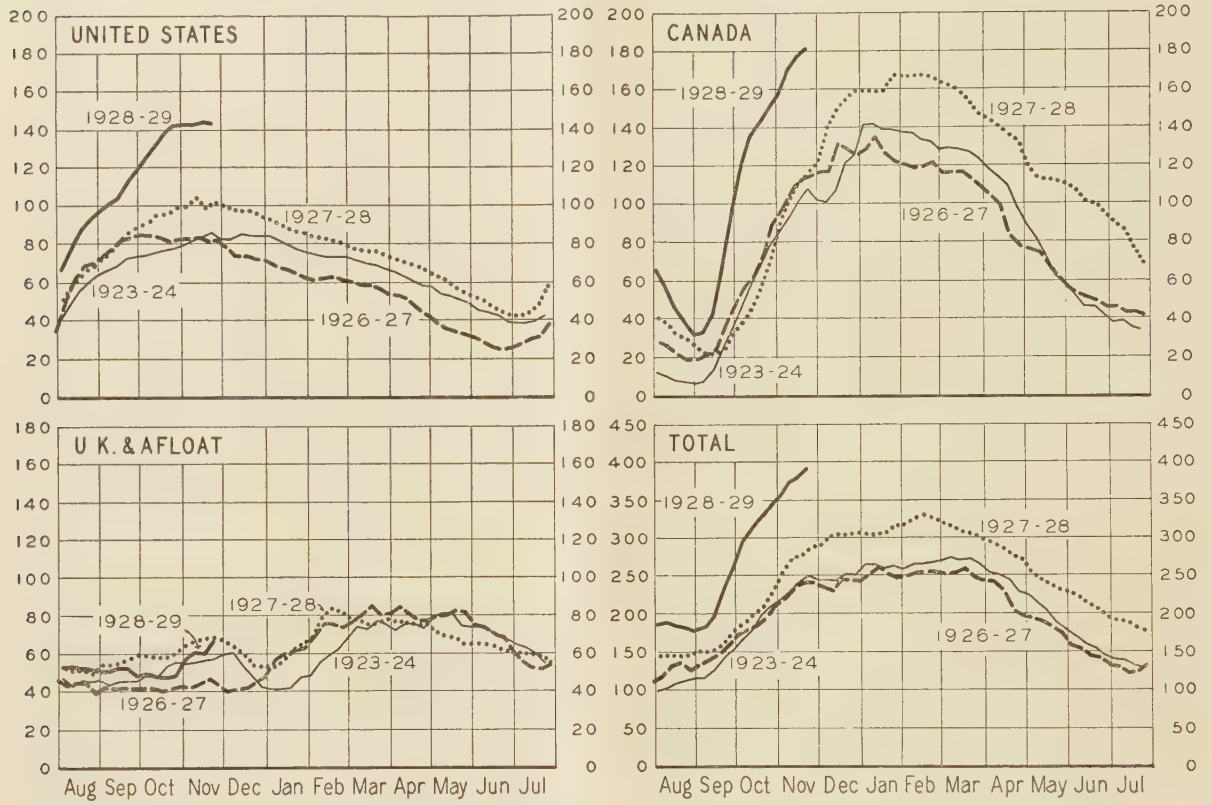
Terminal	1927	1928	Increase
Buffalo	14,302	15,661	1,359
Chicago	6,563	13,190	6,627
Duluth	12,123	20,596	8,473
Kansas City	14,216	19,533	5,317
Minneapolis	20,081	29,692	9,611
Omaha	2,147	9,055	6,908
St. Louis	2,106	4,454	2,348
Wichita	3,697	5,706	2,009
Others	15,801	18,890	3,089
Total	91,036	136,777	45,741

Increases tended to be small at export terminals (except Duluth) and at terminals located in the soft red winter-wheat belt; Boston, New York, Philadelphia, New Orleans, and Detroit, Indianapolis, and Toledo actually had smaller visibles this year than last. This concentration of supplies in interior markets and Duluth suggests that exports from lake ports, where navigation is closed, and from Atlantic and Gulf ports, will not assume large proportions during the winter months.

Canadian visible supplies also were exceptionally large on August 1, as a result of the late harvest and restricted exports in certain portions of the preceding year.[1] They were rapidly reduced during August and September by exports unusually heavy for these months, but failed to reach as low a point as in earlier years. The heavy marketings led to the most rapid increase in history, despite a record export movement in each of the three months September–

CHART 1.—VISIBLE WHEAT SUPPLIES IN THE UNITED STATES, CANADA, AND UNITED KINGDOM PORTS AND AFLOAT TO EUROPE, WEEKLY, 1923–24, AND FROM AUGUST 1926*

(*Million bushels*)



* Data from *Grain World* and *Canadian Grain Statistics.*

[1] See WHEAT STUDIES, December 1928, V, 64.

November. By the end of November the Canadian visible had reached 184 million bushels, some 60 million or 49 per cent more than in 1927, the next highest year.

The distribution of these stocks, with comparisons for earlier years, is shown in Table 4. Stocks at all points except Fort William and Port Arthur were distinctly larger than in any of the preceding five years; but the extraordinarily heavy movement appears not to have resulted in decided congestion at any point except country elevators. Interior and country elevators showed the greatest increase in stocks over 1927, some 32 million bushels out of the

TABLE 4.—CANADIAN GRAIN IN STORE LATE IN NOVEMBER, 1923–28*

(*Million bushels*)

Day nearest November 30	Total	Country elevators Western Division	Interior elevators	Fort William, Port Arthur	Vancouver elevators	Public elevators in the East	U.S. lake and Atlantic ports
1923..	101.6	52.7	.5[a]	19.8	.8	11.5	16.3
1924..	73.7	24.3	2.5[a]	25.6	1.3	10.2	9.8
1925..	104.6	44.6	5.8	12.5	5.0	19.0	17.7
1926..	116.1	35.4	7.5	24.6	7.1	15.3	26.2
1927..	123.8	46.2	6.5	13.7	6.5	19.6	31.3
1928..	184.1	68.9	16.3	24.8	9.4	29.5	35.2

* Compiled from *Canadian Grain Statistics*, and adjusted to bring country elevators in Western Division and interior private and manufacturing elevators into the proper week. Stocks at Prince Rupert included in Vancouver figures.

[a] Figures prior to 1925 are less comprehensive than for later years.

total of 60 million. Nevertheless, considerably more wheat was available for overseas shipment at the close of lake navigation this year than last; stocks at Vancouver, lake, eastern ports, and the Atlantic seaboard were fully 17 million bushels larger than in 1927.

Unlike stocks in the United States and Canada, visibles afloat and in ports of the United Kingdom have not run exceptionally high, except during August and again in late November, in both instances as a result of exceptional shipments from Canada.

Total visibles, influenced as they are by North American figures, have for the first time in history exceeded 350 million bushels, and indeed approached 400 million at the end of November.[1] This quantity of wheat is enough to supply the needs of importers for about six months in a normal year; and such huge supplies in commercial channels have contributed to create a buyers' market. Importers have been able to purchase at a leisurely rate if they so desired, and at other times to purchase heavily without encountering the usual risk of increasing prices sharply. Their position has been further eased by the emergence of unexpectedly large stocks in Argentina, and pressure of offers of old-crop wheat from that country. The Argentine exportable surplus was officially estimated as only 15.5 million bushels as of October 11, but unofficial estimates, based upon direct enumeration of stocks rather than arithmetical calculations of crop minus exports and consumption, were nearly three times as large.[2] The unofficial estimates appear to have been corroborated by subsequent heavy shipments[3] as well as by noteworthy pressure of offers of old-crop wheat to European importers. Year-end stocks in Australia proved large enough to provide more than the usual volume of exports in August–November.

All told, stocks of wheat in the leading exporting countries have run so extraordinarily high by comparison with earlier years that detailed analysis of the differences is unnecessary.

UNITED STATES MILL STOCKS

Visible supply statistics for Canada approximate the total amount of wheat available in Canada aside from farm stocks much more closely than do visible supply statistics for the United States; they include wheat in country elevators and in mill elevators as well as wheat in terminal elevators, while American statistics do not. The huge stocks of wheat in the United States are made more striking by adding to visible supplies the stocks held by city

[1] A different statement of visibles, including small quantities in Argentina and Australia, shows supplies of 459 million bushels on December 1, as compared with 347 million in 1927, when visibles were previously highest for that date. See date in Appendix Table V.

[2] See *Times of Argentina*, October 29, 1928, p. 30.

[3] From October 13 to December 1, Argentine shipments totaled 23 million bushels. See Appendix Table VIII.

mills, either in their own elevators, in country elevators, or in transit. As of September 30, according to census reports, such stocks totaled 127 million bushels in 1928, as against 100 million in 1927 and 104 million in 1926. Mill stocks probably did not decline in October–November, and were perhaps at least 20 to 30 million bushels larger on December 1 this year than last, despite the fact that flour output ran higher this year than last in July–October. This year flour buyers purchased heavily in the early months;[1] and mills, after hedging their sales by purchases of futures, transferred their futures rather rapidly into cash wheat. All told, therefore, wheat stocks as of December 1 were exceptionally high not only in terminal elevators, but also in flour mills. The evidence is less clear concerning stocks on farms and in country elevators, but in these positions also stocks are presumably large.

III. INTERNATIONAL TRADE

According to Broomhall's shipments data as summarized in Table 5, the volume of international trade in wheat and flour was of record size for the first 17 weeks of the crop year. Some 285 million bushels were shipped overseas from the leading exporting countries, 30 million bushels more than in 1924, and 33 million more than in 1927. Despite the fact that shipments data omit certain overland exports from the Danube countries and are apparently more comprehensive in recent than in earlier years, the record size of the international movement is apparent. The relatively low and comparatively stable level of wheat prices, the concentration of supplies in exporting countries, and the relatively large requirements of importers account for the heavy movement, despite the fact that European crops were harvested somewhat early and in good condition. By contrast with 1923, trade was heavy this year not because European countries had smaller wheat crops or because prices were lower, but because in Europe generally population, purchasing power, and a taste for white bread all have grown in the interval. By contrast with 1927, trade was heavier this year principally because prices were lower; two-thirds of the increase appears to be accounted for by increased shipments to ex-European countries, which tend to be more responsive to price changes than European countries are. In 1926, an abnormally high level of ocean freight rates tended to curtail the August-November movement.

TABLE 5.—INTERNATIONAL WHEAT AND FLOUR SHIPMENTS (BROOMHALL), AUGUST–NOVEMBER, 1921–28*

(Million bushels)

Aug.–Nov.	To Europe				To ex-Europe	Grand total
	To U.K.	To Continent	To orders	Total		
1921	56.0	97.5	31.1	184.6	32.8	217.4
1922	55.9	112.3	21.0	189.2	29.6	218.8
1923	59.2	97.6	20.7	177.5	44.4	221.9
1924	66.5	114.0	47.8	228.3	26.7	255.0
1925	50.0	94.4	22.3	166.7	40.8	207.5
1926	54.2	117.2	24.9	196.3	36.5	232.8
1927	60.1	130.1	30.7	220.9	31.1	252.0
1928	57.8	148.2	26.1	232.1	53.1	285.2

* Shipments are for 17 weeks, from Broomhall's *Corn Trade News*.

The course of shipments, in terms of three-week moving averages of weekly data, is shown in Chart 2 for 1923–24, 1926–27, 1927–28, and 1928–29 through November. The usual seasonal trough of July–August was much less marked than usual this year on account of the exceptional exports from Canada out of her record year-end stocks. In November, with Canadian exports moving in unprecedented volume, the usual seasonal peak of shipments became higher than ever before. In the week ending November 24, Broomhall recorded shipments of 22 million bushels,[2] the highest in history.

[1] A bulletin issued by the Millers' National Federation on November 6, 1928, gives flour sales as reported by mills having the indicated capacity as follows for the three months ending September 30, in thousand bushels:

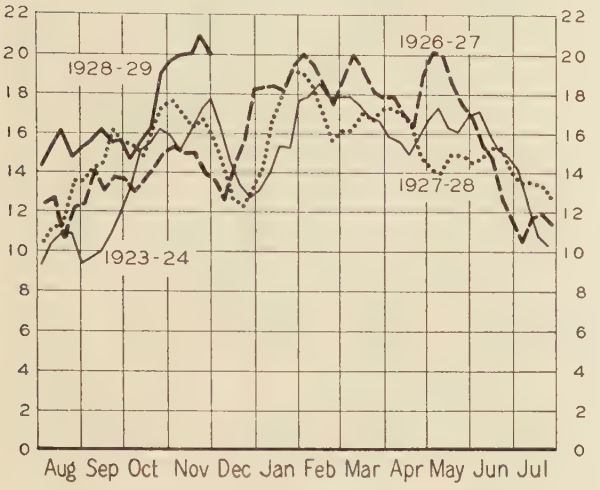
July–September	Daily capacity	Flour sales
1926	363.3	33,283
1927	335.1	27,941
1928	401.4	41,361

The relation of flour sales to capacity for three months was 122.1 per cent in 1926; 108.3 per cent in 1927; and 133.8 per cent in 1928.

[2] See Appendix Table VII.

CHART 2.—INTERNATIONAL SHIPMENTS OF WHEAT AND FLOUR, WEEKLY, 1923–24, AND FROM AUGUST 1926 TO NOVEMBER 1928*

(*Million bushels; 3-week moving average*)



* Broomhall's data, from the *Corn Trade News*.

DISTRIBUTION OF IMPORTS

As usual, a satisfactory insight into the distribution of imports cannot be obtained at this season of the year. Official statistics of net imports of European countries are not available for November, nor of ex-European countries except Egypt and Japan for any month. One must depend chiefly upon Broomhall's shipments data, which do not provide altogether trustworthy comparisons, especially with regard to ex-European trade in earlier years.[1]

Shipments to the United Kingdom, 57.8 million bushels, were below those of 1927, 1924, and 1923, but by no means distinctly small. Net imports (including those of the Irish Free State) during August–November totaled about 67 million as against 82 million last year. Since the August and September figures rather than those of October and November were relatively low, the decline was presumably due partly to the early harvest and good condition of the native wheat crop, and partly—in August at least—to a tendency to restrict purchases on a falling market.

Broomhall's data on shipments of wheat and flour, in million bushels, by continental European countries of destination, are as follows for August–November in the past two years:

Country	1927	1928
France	12.0	14.6
Belgium	24.6	18.1
Holland	30.4	29.4
Germany[a]	24.6	27.2
Italy	20.3	27.8
Greece[b]	5.0	8.0
Scandinavia	7.2	7.8
Austria[c]	4.8	5.1
Spain[d]	1.1	10.1

[a] Includes also Poland and Czecho-Slovakia.
[b] Includes Turkey.
[c] Includes Malta.
[d] Includes Spanish colonies and Portugal.

These data do not disclose the full quantities of wheat carried to the designated destinations, for each country presumably secures some of the wheat and flour reported as shipped to orders. Nevertheless they serve roughly to indicate, if supplemented by official net import statistics appearing in Appendix Table VI, which countries have absorbed the record quantities of wheat exported to Europe in August–November 1928. All these countries except Belgium and Holland appear to have taken more wheat and flour this year than last. Net export statistics for August–October do not altogether support this conclusion. Belgium and Holland were net importers of almost the same quantities in the two years; the decline in shipments to these countries perhaps represents a decline in the transit trade. German net imports, probably as a result of her large crop, were somewhat smaller this year than last. Under the import certificate system, Germany has exported considerable quantities of wheat to England, France, Italy, and other countries this year; hence shipments of foreign wheat to Germany to replace these exports may partially account for the fact that Broomhall's shipments to Germany exceed those of last year.

Net import and shipment data alike confirm larger takings in Czecho-Slovakia, Poland, Austria, and the Scandinavian countries; in these countries low prices of wheat and relatively high prices of feedstuffs seem already to have encouraged heavy importation of wheat. Somewhat the

[1] For comparisons of official net export data with Broomhall's shipments data, see WHEAT STUDIES, November 1927, IV, 11, and August 1928, IV, 340.

same situation prevails in Italy, where the corn crop is short; but the exceptionally heavy imports of the first four months of 1928 in the face of a large domestic wheat crop, were perhaps due in part to the tendency of farmers to hold their wheat, thus keeping domestic wheat prices out of line with foreign wheat prices until the duty was increased on September 12 from 7.5 to 11 gold lire per quintal.

The marked increase in shipments to Greece and Turkey was probably due to a notably short wheat crop in Asia Minor. This year Spain and Portugal, where crops were decidedly short, have apparently taken nearly ten times as much wheat and flour as in 1927. The short crop in Spain induced the government to permit admixture of 30 per cent of imported wheat with the native after September 26; and the figure was raised to 50 per cent on November 11.

Broomhall reports total shipments to ex-European countries in August–November as 53 million bushels, nearly 22 million more than in 1927, and some 9 million more than in 1923–24, the year when post-war prices were lowest and the volume of ex-European trade for the year as a whole reached record proportions. By destination, shipments to ex-Europe in the first 17 weeks of 1927–28 and 1928–29 were reported as follows, in thousand bushels:

Destination	1927–28	1928–29
Central America[a]	11,184	20,624
China and Japan	6,600	11,280
Brazil	8,520	9,648
Egypt	2,856	4,872
North and South Africa	1,544	2,192
Chile	56	....
India	56	3,744
Syria	152	440
Peru	112	128
Palestine	....	128

[a] Includes also Venezuela, West Indies, Dutch East Indies, etc.

The striking features of this tabulation are the heavy shipments to "Central America," to China and Japan, to Egypt, and to India, though increases of minor significance appear with respect to all other countries. Broadly speaking, increases in ex-European imports are to be ascribed to lower prices, especially of flour. But the heavy imports of Japan and China reflect also the poor quality of the Japanese wheat crop, a poor rice crop in China, and apparently a short wheat crop in the province of Shansi and parts of Chihli, tributary to the port of Tientsin. Egypt requires more wheat this year than last because her domestic crop is smaller; and the same is true of Syria and Palestine. Shipments to India of 3.7 million bushels may be taken to represent net imports, for shipments from India have been negligible on account of her short crop. This year India has imported from Canada and Argentina, but Australia remains the major source of her imports.

Sources of Exports

The movement of wheat and flour from exporting countries during August–November 1928 was in several respects distinctly unusual. Table 6 summarizes Broomhall's shipments data, together with official net export data for the four principal exporting countries. Canadian exports bulked exceptionally large; her net exports reached 189 million bushels, as compared with the previous high figure of 129 million in 1922.[1] This was the result partly of the exceptionally large carryover out of 1927–28, which made net exports in August and September, 60 million bushels, the largest in history by some 23 million bushels; and partly of the large new crop and heavy marketings, which permitted November net exports to reach the record total of 81 million bushels. October exports, though the largest recorded, show a less marked contrast with earlier years. The exports of August-November were of record size with respect to flour as well as to wheat, and from Pacific Coast ports as well as from Atlantic and lake ports.

Argentina also exported a larger quantity than in any of the past seven years—some 41 million bushels as compared with only 22 million in 1927 and 32 million in 1923, previously the year of record movement. This heavy movement resulted from heavy stocks on August 1 following the record crop (officially underestimated) of 1927, in

[1] Not all of these net exports, however, pass overseas in August–November. The quantity of wheat held in lake and Atlantic ports of the United States, while recorded as a net export from Canada, is built up between August 1 and November 30; and some of the Canadian net export of wheat goes to the United States for milling in bond.

combination with prospects for another large crop in 1928.

Australia exported a relatively large quantity for the season, though less than in 1923. It is of interest to observe that the crops of 1922 and 1927, although the two smallest of post-war years, permitted the largest August–November net exports following their harvest. Such heavy exports in August–November 1928 suggest that stocks on August 1 must have stood at a rather high level, as in 1923.[1] In years of low prices, Australian farmers apparently tend to market slowly immediately after a short crop, and to release their wheat later if and when new crop prospects are good.

The United States, with a crop of over 900 million bushels, the largest since 1919, exported only 75 million bushels of wheat and flour in the first four months of the year. Smaller exports were made in 1925, when the crop of about 700 million bushels was distinctly short and prices of representative wheats were thereby raised above an export basis. In 1923, when the crop was about 800 million bushels, August–November exports totaled 64 million bushels. The situation then was similar to that in 1928: Canada and Argentina harvested huge crops, wheat prices throughout the world were distinctly low, and American farmers tended to restrict their marketings. But this year the crop is 100 million bushels larger, farmers have marketed their wheat more freely, and visible supplies have run much higher; and since domestic use of wheat for seed, human consumption, and animal feed appear not to have increased in the interval of years by more than half of the increase in the crop, at most, the smallness of the August–November exports is surprising. Exports have been restrained, of course, by prices maintained above a free export basis; and prices seem to have been supported by active mill buying and the unusual shortage of soft red winter wheat.[2] Whether these influences will be modified so that prices will decline and exports increase beyond their normal seasonal levels, or whether prices will remain firm, exports continue relatively small, and stocks be maintained at extraordinarily high levels, is perhaps the most interesting problem in the outlook at the date of writing. In so far as the year 1923–24 provides a criterion, the latter course of events seems the more probable; but it must be remembered that the present crop year differs from 1923–24 in that the weight of supplies seems somewhat heavier.

The outstanding fact requiring emphasis this year is that the United States is a country in which domestic conditions of demand are capable of exerting a more profound influence than they are in Argentina, Australia, or Canada, so that prices at least

TABLE 6.—INTERNATIONAL SHIPMENTS AND NET EXPORTS OF WHEAT AND FLOUR FROM PRINCIPAL EXPORT AREAS, AUGUST–NOVEMBER, 1922–28*

(*Million bushels*)

Aug.–Nov.	International shipments (Broomhall)								Net exports from			
	Total	North America	Argentina	Australia	Russia	Balkans	India	North Africa and Chile	United States	Canada	Argentina	Australia
1922	218.8	183.6	24.8	7.2	....	2.4	.8	....	106.2	128.8	27.3	7.3
1923	222.0	151.2	32.0	14.8	8.8	10.4	4.8	....	64.3	126.2	31.5	18.0
1924	255.2	201.6	24.4	12.4	.4	4.0	12.4	....	149.0	76.0	26.7	14.7
1925	207.6	145.6	18.4	10.4	11.2	9.2	1.6	11.2	35.2	123.9	20.3	12.2
1926	232.8	183.2	7.2	5.6	16.0	15.2	2.4	3.2	104.8	109.3	7.8	6.8
1927	252.0	195.2	20.8	13.6	4.0	12.0	3.2	3.2	126.1	112.9	21.7	12.2
1928	284.8	213.6	35.2	16.0	....	14.0	....	6.0	75.4	189.0	40.6[a]	16.0[a]

* Shipments figures are Broomhall's cumulative totals for 17 weeks from the *Corn Trade News*. These totals for the Balkans, Russia, North Africa, and Chile, do not agree with the weekly data given in Appendix Table VII. Net exports are official data.

[a] November net exports estimated from Broomhall's shipments data.

[1] See Appendix Table X; cf. WHEAT STUDIES, December 1928, V, Appendix Table XXXI.

[2] See below, p. 132.

of some grades of wheat may be maintained above export parity for long periods, even in years of abundant crops. Important contributing factors are relatively ample storage space, agricultural development involving less production of wheat as the sole cash crop of farmers, and the existence of a tariff on wheat.

Precisely what classes of exports have been most affected by the general situation is not yet entirely certain. Thus far in the crop year, exports of flour have been relatively small—the smallest, indeed, in six years, 1925–26 excepted. Clearly the amount of soft red winter wheat available for export has been negligible in view of the short crop. Exports of flour from Pacific Coast customs districts, however, have run exceptionally high because low prices have stimulated purchases for China. Exports of soft wheats from the Pacific Northwest have been curtailed by demand from soft wheat millers in the East to supplement the short crop of soft red winter, and also by local milling demand and by a tendency for farmers to hold their wheat. All told, exports of all flour and of Pacific Coast wheats account for about 36 million bushels of the total American net exports of 75 million during August–November. The balance of 39 million bushels has probably consisted largely of durum. Size of crops considered, exports of all classes of wheat with the possible exception of durum seem to have been unusually small, and even durum perhaps moved less freely than it would have done if excellent crops had not been harvested in northern Africa, southern Italy, and Canada.

Little need be said of the exports of minor exporting countries aside from mention of their small size in absolute terms. According to Broomhall's figures, Russia has made no shipments whatever, though from other sources it appears that a trifling quantity of Siberian wheat shipped from the port of Archangel appeared in England. The concentration of the large Russian crop in the northerly districts apparently precludes exportation; and importation may occur if extreme difficulties arise in collecting grain in these regions and transporting it west and south to consuming centers. India also has exported practically nothing, and indeed has been a net importer; her short crop of 1928 followed three mediocre crops. The Danube countries have exported fairly liberal quantities (14 million bushels according to Broomhall's data, rather more so far as can be judged by incomplete statistics of net exports);[1] but the quantities are small in relation to the reported record wheat crops. High prices of feed grains, due chiefly to the short corn crop, have apparently encouraged the use of wheat as food and feed and curtailed exportation; and farmers have been reluctant to sell at prevailing prices. Chile and the French dependencies of northern Africa have exported liberal quantities from their ample crops, but only a small fraction of world shipments.

IV. WHEAT PRICE MOVEMENTS

The Level of Wheat Prices

Cash wheat prices in the leading markets of the world, in the four months here under review, reached the lowest levels recorded in any year since the beginning of the war, 1923–24 alone excepted. This is partially illustrated by Table 7, which shows August–November averages of selected series of prices in the four great exporting and the four leading importing countries, and of international (British parcels) prices.

As we have previously had occasion to point out, prices do not change their levels from year to year to the same extent in different countries. Thus international prices were higher in August–November 1926 than in any other of the six years, but this was because high ocean freight rates increased c.i.f. prices rather than because the international statistical position was relatively tight. Weighted average prices in the United States were highest in 1925, being affected by an unusually short crop, the influence of which was accentuated because of tariff protection. Argentina had exceptionally high prices in 1925 because the oncoming crop promised poorly.

[1] Net exports from Roumania and Jugo-Slavia in August–September, and from Hungary in August–October totaled 12.8 million bushels.

French prices were relatively low in 1925 because her crop was so large that the tariff was only partially effective.

TABLE 7.—AVERAGE WHEAT PRICES IN LEADING EXPORTING AND IMPORTING COUNTRIES, AUGUST–NOVEMBER, 1923–28*

(*Cents per bushel*)

	1923	1924	1925	1926	1927	1928
British parcels..	120	167	163	168	155	129
United States...	106	136	151	137	129	108
Canada	96	143	138	135	132	109
Argentina	108	152	160	158	142	119
Australia	104	138	144	152	136	117[a]
Great Britain...	112	152	145	158	144	126
France	134	159	151	181	159	160
Germany	100	140	145	174	166	141[b]
Italy	109	162	194	207	179	181[b]

* For importing countries, Argentina, and Canada, prices are from sources noted in Appendix Tables IX and X. British parcels, United States, and Australian prices from sources described in note to Chart 3.

[a] August–September average.

[b] August–October average.

Even with these qualifications, August–November 1923 and 1928 stand out as periods of distinctly low prices. International prices and prices in all four of the leading exporting countries have run distinctly lower in these two years than in any others of the six; and this is true also of British prices of domestic wheat, which are less influenced by changes in the domestic crop or by tariff regulations than are prices in France, Germany, and Italy. In these three countries, largely because tariffs have been raised from year to year, prices in 1928 compare less unfavorably with those of the preceding years; and the comparison would probably be still less unfavorable had not prices in 1926 been raised fortuitously because extraordinarily high ocean freight rates created an exceptional temporary demand for native wheats. Moreover, the average prices of native European wheats in 1928 would presumably be higher if data for November were available, for the seasonal movement is upward.

Chart 3 (p. 130) gives further comparisons; prices in the international market and the leading exporting countries during August–November 1928 are contrasted with prices in 1923–24 and 1927–28. In Great Britain, the United States, Canada, Argentina, and Australia alike, prices have ruled much lower than during any period of 1927–28 except the last week of the crop year. On the whole the level of recent prices is above that which prevailed in 1923–24 until the closing months, though not so far above this level as it is below the level of 1927–28. Some exceptions appear. Weighted average prices in six markets of the United States during September and October were below the level of the same months of 1923, and to a lesser degree this was true of the prices of No. 2 Hard Winter in Kansas City. In 1923–24 the United States crop was smaller, and the country appears to have been nearer to a domestic basis. The prices of No. 3 Northern Manitoba at Winnipeg, at least in late October and November 1928, were closer to the prices prevailing in 1927 than to those prevailing in 1923; for in 1923 No. 3 wheat was one of the three higher grades which were extremely plentiful, while this year those grades are relatively scarce. A weighted average Canadian price, in which sales of the large quantities of Nos. 4–6 wheat exerted their influence, would presumably show the level of Canadian prices to be little above that of 1923. Prices of Barletta wheat in Buenos Aires, which in August were about midway between 1927 and 1923 prices, were much closer to 1923 prices in November. In 1923 the usual seasonal advance occurred toward the end of the year; but this year it was apparently counteracted by the presence of exceptionally large exportable stocks.

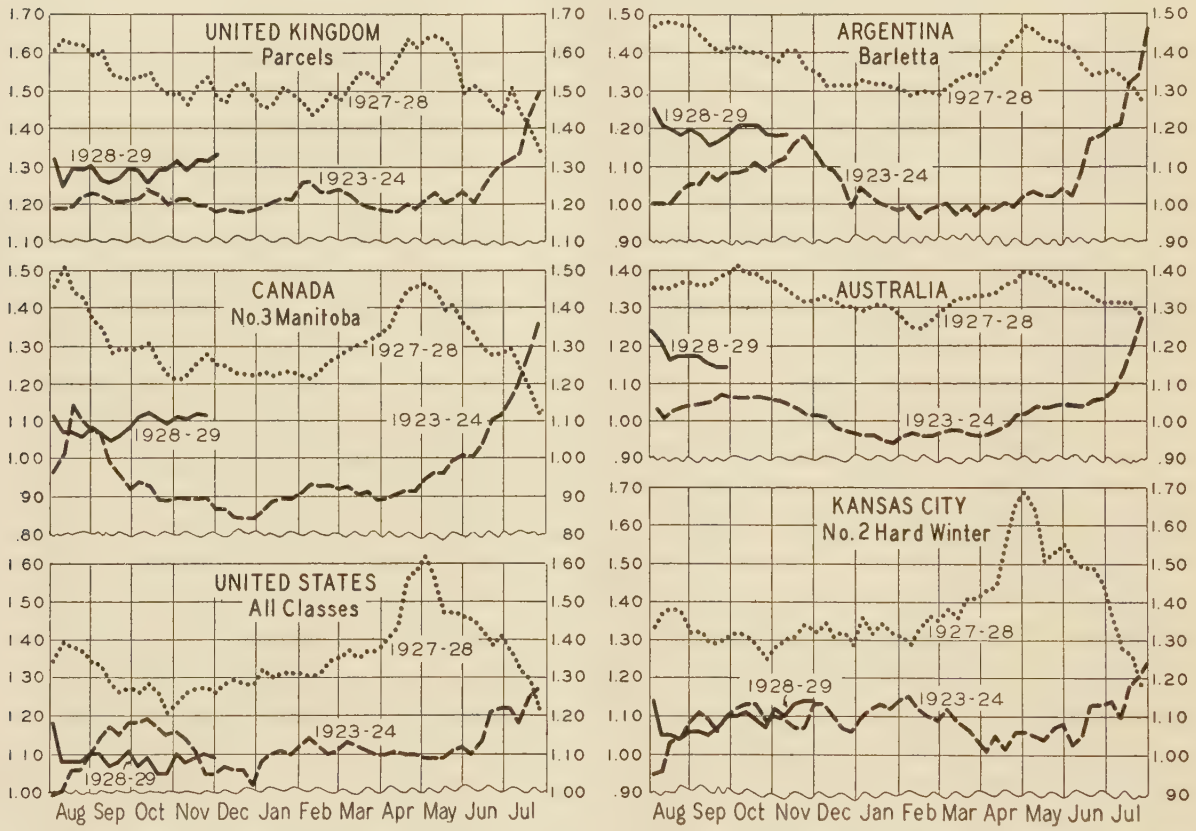
In our judgment the low level of prices thus far in the crop year 1928–29 is a natural reflection of an easy international statistical position, certainly the easiest of any of the past six years except possibly 1923–24. Comparisons of the differences between 1923–24, 1927–28, and 1928–29 are given further consideration below.

With wheat prices generally so low, producers in many countries have complained. In response, little specific governmental action has been taken. In Italy the tariff was increased; and in late October the regulation requiring that millers obtain an extraction of 82 per cent was withdrawn. French producers have requested relaxation of restrictive milling regulations, and admixture of rye with wheat by millers was

rendered optional in early December. In Argentina there has been agitation for governmental fixation of minimum prices, and the President has exhorted grain traders to attempt to secure higher prices for Argentine wheat. On the whole, price-raising tactics seem to have been confined chiefly to restricted marketing by farmers, and, in the United States at least, to reduction of winter-wheat acreage sown for the crop of 1929. Acreage may have been reduced also in western European countries, especially France; but the evidence is not yet clear.

Chart 3.—Weekly Average Prices of Representative Wheat in Leading Exporting and Importing Markets, 1923–24, and from August 1927 to November 1928*

(*U.S. dollars per bushel*)



* United Kingdom prices are averages of sales of wheat parcels in British markets, from *London Grain, Seed and Oil Reporter;* Canadian prices are weekly average cash closing prices of No. 3 Northern Manitoba at Winnipeg, from *Canadian Grain Statistics;* United States prices are weighted averages of all classes and grades of wheat in six markets (five markets in 1923–24) and No. 2 Hard Winter at Kansas City, from *Crops and Markets;* Argentine prices are Friday quotations from *International Crop Report and Agricultural Statistics,* for 1923–24, and averages of daily prices from *Revista Semanal* from August 1927; Australian prices are averages of weekly quotations for export wheat at Melbourne furnished directly by an Australian correspondent.

The General Course of Prices

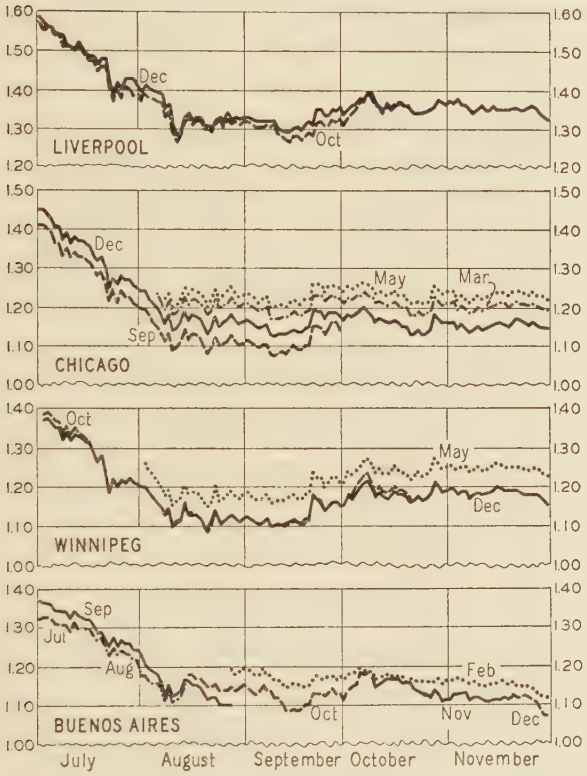
Wheat prices in most important markets showed no decided trend during August–November. Chart 4 shows daily fluctuations in futures prices at Liverpool, Chicago, Winnipeg, and Buenos Aires; the movements of cash prices appear in Chart 5 (p. 133) and in Appendix Tables VIII and IX. In Italy, as usual, the seasonal tendency of domestic wheat prices was upward after the low level was reached in August, following heavy marketings. In England, France, and Germany, where harvest is later, the low point for the four months was reached in September.

The relative stability of futures prices was the outstanding feature of the period; it is seldom indeed, in a period ordinarily characterized by uncertainty regarding outturns in the North American spring-wheat

belt and in many European countries, that futures prices fluctuate within such narrow limits. This year Canadian crop developments were so consistently favorable that a large crop appeared distinctly probable as early as July. The crop approached maturity rather early, so that fears of frost damage were less prevalent than usual, and rust was never in evidence sufficiently to

CHART 4.—DAILY CLOSING PRICES OF PRINCIPAL WHEAT FUTURES IN FOUR LEADING MARKETS, JULY–NOVEMBER 1928*

(U.S. dollars per bushel)



* Data from *Chicago Journal of Commerce* and *Daily Trade Bulletin*, Chicago.

cause alarm. In Europe and in the United States all early indications of large crops were substantiated by subsequent developments. On the other hand, general expectations were not raised appreciably, since the August–September drought in Australia and the unexpectedly poor grading of Canadian wheat in September and October served roughly to offset favorable developments elsewhere.

The principal movements common to prices in all four of the leading futures markets were a sharp decline in early August, and a moderate upswing from mid-September to early October. The August decline was a continuation of the sharp break begun early in May. With the crop outlook improving from week to week, practically throughout the Northern Hemisphere, and with the large Canadian stocks pressing upon the world markets, some such decline was inevitable. It was checked on August 13 and 14 partly by the appearance of the official Canadian report of condition, which was interpreted by some to indicate a crop of only 450 million bushels in the Prairie Provinces, as compared with generally expressed belief that nearer 550 million bushels would be harvested; and partly by forecasts of a frost in Canada. Again on August 22 and 23 frosts in Canada gave rise to a bulge in prices, but for a time thereafter movements were slight in all markets.

After September 10, however, the tendency was slightly upward; and a sharp upturn, amounting to as much as 6 cents in Winnipeg, occurred on September 21. Nothing appeared in the news of the day respecting an alteration in the crop outlook; and the upturn appears to have been due to nothing more tangible than a general tendency for short sellers to "cover." One cannot ascertain what caused this short covering—continued reports of drought in Australia, or low grading of new Canadian wheat, or a rumor that a prominent Chicago speculator had "gone long." After a brief reaction, the advance continued; since it was more marked in Winnipeg and Liverpool than in Chicago, we infer that the poor grading of wheat in Canada was the principal cause. The spread between cash prices of No. 1 and No. 6 Northern Manitoba at Winnipeg, 29 cents on September 10, had widened to 42 cents on October 6, when the advance was checked; the grading of new-crop receipts suggested that grades deliverable on futures contracts would be less plentiful than had been supposed, and futures prices tended as usual to move with the prices of deliverable grades. Prices fell sharply on October 8, following the issuance of the Northwest Grain Dealers' Association's estimate of a

crop of 558 million bushels for the Prairie Provinces; and thereafter prices tended to sag. A temporary upturn occurred on October 27, most marked in Chicago. For this advance, so far as one can learn from the trade press, no better reason appears than further short covering, in this instance perhaps induced by Mr. Hoover's announcement of his intention, if elected, to convene a special session of Congress to deal in part with farm relief, or perhaps by Secretary Jardine's statement further urging farmers to hold their wheat, or perhaps by news of drought in the Bahia Blanca region of Argentina.

Many American traders expressed surprise at the firmness of prices during September–November in the face of what was termed bearish news. But in retrospect the general situation, at least as applied to markets outside the United States, appears not to have grown distinctly more bearish after mid-August except as concerns the increase of visible supplies in North America. If crop prospects improved in some countries, they deteriorated in others.

The firmness of prices in the United States in the face of her huge crop is another matter. That prices of representative wheats remained high relative to foreign markets is sufficiently obvious from the fact that such wheats could not be exported in a volume proportionate to the size of the crop; similar wheats could be obtained more cheaply elsewhere. But they could not consistently have been obtained more cheaply elsewhere if some factor had not tended to restrain American prices from declining. Two factors seem to have operated. Exceptionally heavy purchases by domestic mills kept prices of hard red winter wheat out of line with prices of comparable Canadian and Argentine wheats, especially in July and August; this was possible partly because the Canadian and Argentine carryovers were exceptionally large and importers were able to satisfy their demands in those markets. Again, the short crop of soft red winter wheat gave rise to an unusual demand for substitute soft wheats from the Pacific Northwest, and raised prices there out of line with foreign markets. The tendency of farmers to market their wheat slowly seems to have been a contributory factor of some importance.

Throughout August–November, speculative activity as measured by the average daily volume of futures trading remained at a relatively low level, at least in the United States,[1] and so far as can be determined, in foreign markets as well. The persisting bearishness of the supply situation has discouraged speculation everywhere, as was the case in 1923 and to a lesser extent in 1927. Trading in stocks and perhaps in corn may have appeared to many as more attractive than trading in wheat. The relatively small volume of trading may perhaps be said to have contributed to the stability of wheat prices; but inactive trading was probably a reflection of the consistently bearish statistical position which caused stability of prices, rather than an independent factor which directly tended in any appreciable degree to minimize price fluctuations.

The relations of near and distant futures in the several markets showed few peculiarities. Most striking, perhaps, were the discounts of near futures under the distant in Buenos Aires, an unusual situation reflecting the abundance of old-crop wheat in the closing months of the Argentine crop year. With visible supplies exceptionally heavy, the discounts of near futures under distant ones were also unusually large in Chicago. The October future in Winnipeg usually commands a higher premium over the December than was true this year, a circumstance probably due to the fact that early harvest assured plentiful supplies of wheat for delivery on October contracts. The premium of the Winnipeg May over the December was also larger than usual, a reflection of the exceptional quantity of wheat which must be carried in Canada throughout the winter months.

United States Cash Prices

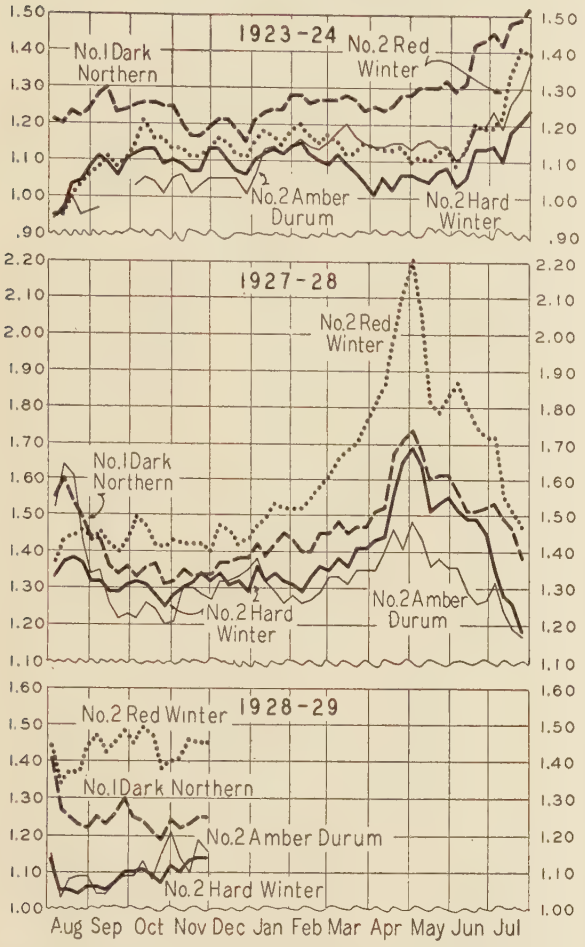
Cash wheat prices of four important types of American wheats for the years

[1] The average daily volume of future trading in all United States markets in the four months of the period has run as follows in the past six years, in million bushels:

	August	September	October	November
1923.....	31	28	30	27
1924.....	50	43	61	61
1925.....	60	59	60	65
1926.....	47	46	44	53
1927.....	42	37	37	35
1928.....	42	34	35	33

CHART 5.—WEEKLY AVERAGE CASH PRICES OF TYPICAL WHEATS IN UNITED STATES MARKETS, 1923–24, AND FROM AUGUST 1927*

(*U.S. dollars per bushel*)



* No. 2 Red Winter at St. Louis, No. 2 Hard Winter at Kansas City, No. 1 Dark Northern Spring and No. 2 Amber Durum at Minneapolis. Data from *Crops and Markets*.

1923–24, 1927–28, and the first four months of 1928–29 are shown in Chart 5. This year, as in 1927–28, No. 2 Red Winter has commanded high premiums on account of the distinctly short crop. No. 1 Dark Northern has commanded about the usual premium over No. 2 Hard Winter, though rather a larger one than in the early months of 1927–28. In 1927 the spring-wheat crop was of about the same size as in 1928, but the winter-wheat crop was smaller. No. 2 Amber Durum has been sold at relatively higher prices this year than last at least in some weeks, despite a larger crop this year; but the price of this grade of amber durum does not reflect the average price of the durum crop, because amber durum of good color is scarce and is commanding considerable premiums over red durum and poorer qualities of amber durum.

In 1923–24 hard spring wheat, not soft red winter, was the premium variety; the crop of spring wheat was smaller than in 1928, that of soft winter larger. It is interesting to observe that, while weighted average cash prices in the United States as a whole were lower in September–October 1923 than in the same months of 1928 (see Chart 3, p. 130), this was not true of any of the four grades shown in Chart 4. Possibly a relatively larger volume of sales of lower grade wheats in 1928 than in 1923, particularly of durums, accounts for the anomaly; but the fact that weighted average prices are built up from sales in six markets in 1928 and five markets in 1923 may also be significant. Prices tend to be relatively low in Omaha, the sixth market.

V. THE INTERNATIONAL POSITION AND OUTLOOK

Evaluation of the international statistical position is essential in forming opinions respecting the outlook for international trade, world prices, and carryovers for ensuing months and the crop year as a whole. No altogether satisfactory method now seems available to afford precise numerical expression to the central feature of the statistical position in different years—the width of the margin between "export surpluses" and "important requirements." One seeks some method of showing how prices must change as these margins change; but the difficulty always arises that the price changes affect the margins. For the current as well as past years, moreover, large differences in estimates of margins are possible if different crop estimates are employed. Nevertheless the margin in 1928–29 seems the widest of any in the past six years except 1923–24. It is obviously much wider than in 1924–25 and 1925–26. But to measure the differences between the margins of 1923–24, 1927–28, and 1928–29, all of which are relatively wide, is difficult; and measurement undoubtedly must de-

pend in part upon assumptions. Statistics of production and consumption in particular are imperfect, and permit wide divergences of opinion in their interpretation.

The International Statistical Position

We may first undertake comparisons between 1927–28 and 1928–29. Last year, according to the official estimates of production, the four principal exporting countries (the United States, Canada, Argentina, and Australia) secured crops totaling 1,674 million bushels. But the crops of Canada and Argentina were almost certainly underestimated,[1] probably by the large amount of 70 million bushels, more or less. The total crop in the four major exporting countries probably came nearer to 1,745 million bushels. The outturns of 1928 in these countries are still uncertain. Elsewhere we have expressed our view[2] that standing official estimates for Canada especially, and to a lesser degree Australia, are below the truth, in all by perhaps 60 million bushels. With this allowance, and the assumption that the Argentine crop is at least 250 million bushels,[3] and accepting the standing official estimate for the United States, we conclude provisionally that the crop in these four countries combined approximates 1,870 million bushels, or 125 million more than in 1927. The true exportable surplus may perhaps prove larger than last year by somewhat less than 125 million bushels; for domestic utilization for food and feed (probably not for seed) will doubtless be appreciably larger this year than last. But the inward carryover was also appreciably larger, and may about offset this increase.

Exportable surpluses in minor exporting countries apparently differ little between 1927–28 and 1928–29. India and Russia appear to have less wheat available for export, but they had only a little last year. The Danube countries, the French dependencies in northern Africa, and Chile together appear to have domestic crops enough larger to balance the defections of Russia and India, though exportable surpluses in these minor exporting countries cannot be estimated so satisfactorily as those of the major exporting countries.

This year one of the chief problems is to determine to what extent apparent exportable surpluses in the Danube countries are reduced by short crops of corn, and to what extent, if any, the wheat crops are overestimated. Wheat crops in these countries appear to be 86 million bushels larger than in 1927; even if the 1928 wheat crops are somewhat overestimated, and the corn crops are apparently 70 million bushels smaller than in 1927, the exportable surplus of wheat is presumably larger this year than last. The total increase in wheat production will by no means be employed to make up the domestic deficiency in corn production; rather, less corn will be exported and more not only of wheat, but also of oats, rye, and barley will be employed to replace corn. The barley crops are apparently 19 million bushels larger this year than last; the oats crops 15 million bushels larger; and the rye crops 16 million larger. All told, it seems probable that the Danube countries have exportable surpluses of wheat almost enough larger than those of 1927–28 to balance smaller exportable surpluses in Russia and India. If so, and if exportable surpluses in the four leading exporting countries are as large as we suppose, then world exportable surpluses exceed those of 1927–28 by well over 100 million bushels.

Import requirements are still more difficult to evaluate. Three aspects of the situation are clear: European importing countries have larger crops of wheat and also of its chief substitute, rye; but on the other hand the list of net importers is increased over that of 1927–28 by the addition of Spain and countries in Asia Minor; and growth of population alone increases the quantity of wheat needed. The effect of these three factors on total requirements, *at equivalent prices,* is not susceptible of precise measurement; yet certain rough estimates are helpful.

The 1928 wheat crop of European importing countries (all Europe except Spain and the Danube countries) now appears to

[1] See Appendix Table X.

[2] See above, pp. 116, 119.

[3] This assumption now seems reasonable in view of the large area sown in Argentina and favorable Argentine reports of crop conditions. It implies a yield per acre above average, but perhaps not so high as in 1927.

reach 890 million bushels, as compared with 838 million in 1927. Last year, however, quality was much poorer. An unmeasurable quantity of wheat was unfit for milling, and because of its lighter weight, a given quantity of wheat would produce less flour. How accurate crop estimates are for each of the two years is impossible to say; unofficial observers state that the French crop of 1927 was officially underestimated, but this opinion appears to rest rather upon private crop estimates—presumably not so comprehensive as the official—than upon statistics of French trade, milling, or consumption, not all of which are available. If we accept official crop estimates, and if unmillable and light-weight wheat constituted a larger proportion of the crop in 1927 than in 1928, then domestic wheat supplies in the European importing countries are effectively larger this year than last year, unless carryovers into 1927 were distinctly larger, as appears improbable. The total European (ex-Russian) rye crop of 1928 appears to exceed that of 1927 by 94 million bushels, though some 16 million bushels of this increase occurred in the Danube exporting countries; and rye, like wheat, is of better quality this year. Import wheat requirements this year are somewhat less than last year partly because more rye is available.

The addition of Spain and Asia Minor to the list of European net importers can hardly suffice to turn the balance toward higher European requirements in 1928–29. Demand from Spain is unlikely to bulk large so long as the import duty on wheat remains around 74 cents per bushel; and the demand from Asia Minor is presumably the sort which involves importation quite as much because prices are low as because domestic supplies are short. Nevertheless these countries presumably would take, at equivalent prices, somewhat more wheat in 1928–29 than in 1927–28, perhaps by 25 million bushels. The increase in total European requirements due to increase in population alone serves further to raise the needs of 1928–29 in comparison with those of 1927–28. This increase perhaps amounts to some 15 million bushels per year. One may roughly conclude that growth of population and the addition of Spain and Asia Minor perhaps increase European import requirements, at equivalent prices, by almost as much as larger and better wheat and rye crops decrease them, and that these requirements will be about the same as last year.

The ex-European requirements, in the same sense, appear to be larger in 1928–29 than in 1927–28. Egypt has a smaller wheat crop, Japan a wheat crop of poorer quality, China a poorer rice crop; and India must import rather than export wheat. Moreover, ex-European requirements tend to increase regardless of price changes. To express them numerically is not feasible. It seems improbable, however, that at equivalent prices ex-Europe would require as much as 50 million bushels more wheat in 1928–29 than in 1927–28. These countries actually may import over 50 million bushels more this year than last, but they will do as much because prices are lower as because they demand more wheat at the same price.

Hence the general position for the crop year 1928–29 appears easier than in 1927–28 because export surpluses are enough larger to do more than counterbalance larger total import requirements (at corresponding price levels), which are increased in ex-Europe rather than in Europe. Our analysis implies that the lower international wheat prices prevailing this year have been the natural result of economic conditions, not the result of an incorrect appraisal of the situation by dealers throughout the world. A contrary view is implied, though not expressly stated, in current analyses of the wheat situation issued by the Bureau of Agricultural Economics of the United States Department of Agriculture;[1] but the many differences of detail need not be considered here. It perhaps suffices to point out that the Department's analysis rests upon prices in relation to world crops and (apparently) world demand, whereas in our view the distribution of crops as well as their size is of fundamental significance; that they probably overstate the extent to which the world demand for wheat (in a

[1] See especially *Foreign News on Wheat*, issues of August 20, September 19, October 20, and November 21, 1928; and statements by Secretary of Agriculture Jardine in press releases issued August 23, October 27, and November 15, 1928.

technical economic sense) is increasing; and that they may have understated the effective crop of Canada.

Comparisons of the international statistical position in 1923–24 and 1928–29 require less attention to details. In 1923 the wheat crops of the four major exporting countries totaled some 1,640 million bushels, about 230 million less than in 1928. But the exportable surplus from these countries was not 230 million bushels smaller in 1923–24 than in 1928–29, for domestic requirements have increased over the interval, probably by more than 65 million bushels for food and seed alone. Among the minor exporters, India, with a crop of 372 million bushels, was able to furnish net exports of 20 million bushels, and Russia, despite a smaller crop, was able to furnish about 21 million; whereas this year these two countries are not likely to make an appreciable net export. Larger exportable surpluses in these countries in 1923–24 about counteracted smaller surpluses in the Danube countries, where the wheat crop was about 100 million bushels smaller than in 1928 but the corn crop was 63 million bushels larger. Total exportable surpluses were probably not much more than 150 million bushels smaller in 1923–24 than in 1928–29.

Over against this, one must set the fact that import requirements were much smaller in 1923–24. The wheat crop in European importing countries was about 30 million bushels smaller in 1923 than in 1928, and the rye crop was about 60 million smaller. But if growth of population alone increases European wheat requirements by around 15 million bushels a year, requirements in 1923–24 must have been some 75 million bushels smaller than in 1928–29. Since Spain and Asia Minor had good crops in 1923, total requirements were thereby lessened by comparison with 1928–29. They were reduced still further, to an unmeasurable but certainly important amount, by comparatively lower purchasing power and a less developed taste for white bread. Ex-European requirements also were considerably smaller in 1923–24 than they appear to be in 1928–29. India was not a net importer in the earlier year, and population in ex-European wheat-importing countries has increased in the interval. Although precise allowances cannot be made, it seems probable that total import requirements in 1923–24 were a little farther below those of 1928–29 than were exportable surpluses, and hence that the margin between requirements and surpluses was a little larger in the earlier year.

The Price Outlook

Our analysis of the international statistical position implies that international wheat prices—average prices of c.i.f. wheats as recorded in our series of British parcels prices or in prices derived from quantities and values of British imports—may be expected to remain, during the ensuing few months, at a level somewhere between the levels of the corresponding period in 1923–24 and 1927–28—probably nearer to the earlier level than to the later. It is in January–March of each year rather than throughout the crop years, that the statistical position for the year is most clearly the dominant influence on prices, although Southern Hemisphere harvests can reasonably be expected to exert special influences. In earlier months the supply situation is usually less clear, and in later months the crop outlook for the new year begins to exert an influence, especially the winter-wheat crop in the United States.

During these mid-winter months international prices may be expected to fluctuate within fairly narrow limits, probably with no definite trend. A considerable decline might occur if offers of American or Argentine wheat were pressed, but decided pressure of American offers seems improbable. The full weight of the Southern Hemisphere crop movement probably remains to be felt. The Argentine crop, though as yet its size is not definitely known, is clearly a large one; selling pressure always tends to be heaviest at this season; and thus far in the crop year, except in December, forward sales appear to have been relatively small in relation to the large crop—chiefly because sales of the heavy year-end stocks of old-crop wheat rather than of new-crop wheat were pressed in October–November.

A considerable rise in prices might of course occur under the stimulus of a sudden and protracted increase in demand;

but such an increase seems improbable in view of the heavy European and ex-European takings during August–November. Hopes for higher international prices must rest principally upon the emergence of Russia as an importer on a rather large scale. Some imports will perhaps be made, but heavy takings are unlikely unless adequate transport of wheat within Russia is physically impossible or the cost of wheat laid down in consuming centers from the northerly regions of Russia is greater than the cost of wheat transported from Danubian ports.

Seasonal movements of prices in exporting countries may reasonably be expected to alter the relationships with international prices prevailing in August–November. In Argentina and Australia the mid-winter seasonal movement in years of large crops seems to be downward; in the United States and Canada, upward. But this year wide movements seem unlikely.

In the early spring months, prices will be subjected to the influence of new-crop prospects, especially for United States winter wheat; and these cannot be foreseen. On the whole, however, the broad probabilities suggest higher prices in 1929–30, merely on the ground that a repetition of a distinctly high average yield per acre throughout the world is improbable, and that the area sown to winter wheat, certainly in the United States and apparently in western Europe, has decreased.

Probable Net Exports and Outward Carryovers in 1928–29

Heavy import requirements, together with low wheat prices and high corn prices tending to encourage the use of wheat for food and feed, promise to raise the volume of international trade this year to the highest level in history. The movement from net exporting countries may reach about 875–925 million bushels, as compared with the record figure of 846 million in 1926–27 and 818 million bushels last year.

Table 8 shows our advance estimates of probable net exports in 1928–29 from the various exporting countries, in comparison with estimates by Broomhall and the United States Department of Agriculture. The three sets of estimates are not strictly comparable: Broomhall's figures are for probable overseas shipments, which always fall below net exports; and the Department's figures are for net exports in July–June, not in August–July. We regard our estimates for individual countries and in total as approximations to the middle of a range. They are calculated, moreover, on assumptions set forth in the earlier pages respecting the size of 1928 crops.

Table 8.—Net Exports of Principal Exporting Countries in 1927–28, with Forecasts for 1928–29*

(*Million bushels*)

Exporting area	Net exports 1927–28	Forecasts for 1928–29		
		U.S.D.A. Oct. 20	Broomhall Nov. 20	F.R.I. Dec. 20
United States...	184	200–220	136	155
Canada	332	345–390	368	420
Argentina	178	125–160	184	160
Australia	70	75–85	96	100
Russia	...	[a]	[a]	...
Danube basin[b]..	33[c]	65–90	40	50
India	9	[a]	[a]	[a]
Others	12	2–5[d]	16	15[e]
Total	818	812–950	840	900

* Net export data are from official sources and International Institute of Agriculture; U.S. Department of Agriculture forecasts from *Foreign News on Wheat: World Wheat Crop and Market Prospects*, October 20, 1928. Figures are for crop year August–July, except U.S. Department of Agriculture estimates which are for the year July–June. Totals are for items listed in table, and are not strictly comparable with each other.

[a] Net import.
[b] Roumania, Bulgaria, Hungary, and Jugo-Slavia.
[c] Partially estimated.
[d] Algeria and Tunis.
[e] Algeria, Tunis, Morocco, Chile.

Despite the large size of the wheat crop in the United States, we regard our estimate of net exports of 155 million bushels as generous. The seasonal movement of American net exports is fairly well marked. In each of the past seven years except 1925–26, net exports during July–December have constituted between 65 and 77 per cent of total exports for July–June. The year 1925–26, when the crop was short, was an exception; and January–June exports were increased relatively to July–December exports because a favorable new-crop outlook in the spring of 1926 gave rise to exceptional seasonal exports in May and June.

In that year July–December exports were only 54 per cent of the annual total. Since the year 1928–29 resembles 1925–26 less than it resembles others of the past seven years, it seems reasonable to assume that July–December net exports will constitute 65–77 per cent of the annual total. July–November exports totaled 81 million bushels; and from the experience of past years it seems proper to assume that December exports will fall below those of November. If so, July–December exports may reach 93 million bushels, and July–June exports may fall between 120 and 145 million bushels, or, including shipments to possessions, 3 or 4 million bushels more. But in so far as the usual seasonal movement may be altered, it will presumably lead to a larger percentage of exports than usual in the last half of the year, for the crop is so large as to give rise to more than the usual amount of pressure to sell, especially if world prices move upward in the spring months. August–July exports will probably prove larger than July–June exports, since the figure for July 1928 was unusually small.

If net exports and shipments to possessions reach only about 155 million bushels, including wheat and flour, the outward carryover promises to be extremely large. If one allows some 90 million bushels for seed requirements, the relatively large quantity of 95 million bushels for wheat fed and wasted, 507 million bushels for human consumption, and assumes the crop estimate and the inward carryover to be correct, then year-end stocks (including city mill stocks) may reach about 200 million bushels, certainly the largest quantity in recent years.[1]

Net exports from Canada may reach some 420 million bushels, on the assumption that the crop approximates 550 million. In reaching so high a figure we assume that the outward carryover will prove smaller than the enormous carryover into 1928–29 (which was in part the result of a delayed harvest in 1927) yet larger than in any other year. Grain unmerchantable and lost in cleaning may approximate 63 million bushels, over 10 per cent of the crop, because of the large proportion of low-grade grain, but this figure can be scarcely more than a guess. Our estimates both of the carryover and the item for feed and waste are necessarily subject to a wide margin of error. But record exports from Canada of at least 400 million bushels seem certain on account of the record crop, the record carryover in, and the record August–November export movement. Net exports of 190 million bushels passed from Canada in August–November; and if exports in the balance of the year are no larger than those of December–July 1927–28, the total for 1928–29 will exceed 400 million bushels.

If the Argentine crop approximates 250 million bushels, and if stocks on August 1, 1929 are about the same as on August 1, 1928, net exports will probably reach or exceed 160 million bushels. Exports of about 41 million bushels were made in August–November. In December–July, Argentina usually exports between 57 and 60 per cent of her total crop, though for special reasons involving the disaster to the crop of 1925 the percentages were lower in 1924–25 and 1925–26. If the crop of 1928 approximates 250 million bushels, December–July exports may reach 140–150 million bushels, or 180–190 for the crop year August–July. We employ a lower figure because domestic disappearance of wheat in Argentina has been growing rapidly; but our estimate of 160 million bushels is probably too low.

Except in 1922–23, December–July net exports from Australia have in recent years amounted to 52–66 per cent of the total crop, the lower figure being recorded in 1927–28, when the crop was small, and the higher figure in 1924–25, when international prices were distinctly high and the Australian wheat crop was large. Some 60 per cent, or 96 million bushels may be exported in December–July 1928–29, if the crop reaches 160 million bushels. Since August–November exports were 16 million bushels, the indicated total for the year on this basis of calculation is 112 million bushels. We employ a figure of 100 million bushels, on the assumption that stocks may be built up in the course of the year and that low prices will tend to restrict exports; but our estimate appears conservative.

[1] See Appendix Table X for our estimate of disposition in the four principal exporting countries.

Less satisfactory bases appear for estimating the net exports of the minor exporters in 1928–29; the situation is especially confused by the short corn crop of the Danube countries and by uncertainty regarding the crop estimates. If each of these countries were to retain for domestic use no more wheat than in the post-war year of maximum retention, net exports from the four countries together might exceed 95 million bushels. But with growing per capita consumption of wheat, the possibility that standing crop estimates are too high, the short crop of corn, and comparatively small exports in the early months of the year, this figure seems much too high. Exports of approximately 50 million bushels, mostly from Hungary and Jugo-Slavia, seem more probable; and this figure now appears liberal. Algeria, Morocco, Tunis, and Chile together may furnish 15 million bushels more. But India promises to be a net importer, though perhaps not to any considerable extent if the crop to be harvested in March–May is a large one. Russia appears to have no appreciable amount of wheat geographically available for export, and net imports are probable.

With respect to the outlook for total net exports in 1928–29, our estimate differs from those of Broomhall and the United States Department of Agriculture chiefly in being a little higher. But the difference is comparatively small. Broomhall on November 20 expressed the belief that shipments might reach 880 million bushels, and shipments always fall below net exports; and the center of the range of the Department's estimate, 881 million bushels, is only 19 million below our figure. With respect to details, the Department's estimates for United States exports of 200–220 million bushels appear too high; its Canadian, Argentine, and Australian estimates too low, at least the minimum figures; and its maximum for the Danube countries too high. Broomhall's estimates appear low for Canada and somewhat liberal for Argentina; but they differ from our own largely because he accepts the official Canadian crop estimate and assumes an outturn of 260 million bushels in Argentina.

If net exports are to reach 900 million bushels, net importing countries must take some 80 million bushels more than in 1927–28. Most countries will probably take more, but especially the ex-European. Of the European countries, Spain, Portugal, the Scandinavian countries, the Baltic states, and central European countries appear likely to increase their imports most; Spain and Portugal have short crops, and the others are the European countries which tend most noticeably to import wheat heavily when prices are low. The major importers, Great Britain, Italy, Germany, and France, may take no more wheat this year than last as a group, though the situation is not clear. Great Britain has a smaller domestic wheat crop, her imports in 1927–28 were not large, and low prices may encourage imports; on the other hand, the domestic wheat crop last year was much poorer in quality, and per capita consumption is tending downwards. Larger imports into France in 1928–29 than in 1927–28 are possible because prices are lower even though the millable quantity of domestic wheat is larger this year, and because consumption may be encouraged by the removal of admixture requirements. Germany and Italy, with larger and better quality wheat crops, may import less this year; but in Italy relaxation of milling restrictions may encourage consumption of white bread, and the short crop of corn will tend to expand the use of wheat both for food and feed. Belgium and Holland may import rather less wheat this year, since their native wheat crops are better in size and quality. All told, European countries bid fair to absorb some of the probable 80 million bushel increase in world wheat and flour exports, but perhaps no more than a fourth or a third of it. If Asia Minor is treated as a part of Europe, the proportion taken by Europe may prove larger.

The balance promises to go to ex-European countries, with practically all countries increasing their imports noticeably. Most ex-European countries import a large proportion of wheat as flour, so that international trade in flour promises to run high in 1928–29.

The outlook for international trade is, of course, dependent upon price movements in the latter half of the year. If prices rise sharply at any time, the demand from

many ex-European and some European countries may be expected to drop off sharply; for heavy purchases are to be regarded rather as the result of low prices than as a potential cause for high prices. European purchases might, however, increase if prices rose in the early spring months, though past experience suggests that sharply rising prices shortly before harvest of domestic crops tends to restrict importations. In general we have tended to estimate probable net exports conservatively, because the broad probabilities suggest that rising rather than stable or declining prices are in prospect in the spring or early summer, and rising prices would on the whole tend to restrict rather than to encourage import purchases, at least among ex-European countries. If prices rise little, net exports may exceed 900 million bushels.

This study is the work of M. K. Bennett, with substantial assistance from Joseph S. Davis and Alonzo E. Taylor, and with the aid of Katharine Merriam and Janet Murray. The Institute is indebted to Mr. P. C. Rutherford of Minneapolis for information on the situation in the United States spring-wheat belt.

APPENDIX

Table I.—Wheat Production in Principal Producing Areas, 1920–28*

(Million bushels)

Year	United States	Canada	India	Australia	Argentina	Chile	Uruguay	Hungary	Bulgaria	Jugo-Slavia	Roumania	Soviet Russia	Mexico
1920.....	833.0	263.2	377.9	145.9	156.1	23.2	7.8	37.9	29.9	43.0	61.3	.....	15.0
1921.....	814.9	300.9	250.4	129.1	191.0	23.6	10.0	52.7	29.2	51.8	78.6	.....	5.1
1922.....	867.6	399.8	367.0	109.5	195.8	25.9	5.2	54.7	32.6	44.5	92.0	.....	13.6
1923.....	797.4	474.2	372.4	125.0	247.8	28.1	13.3	67.7	29.1	61.1	102.1	419.1	13.7
1924.....	864.4	262.1	360.6	164.6	191.1	24.5	9.9	51.6	24.7	57.8	70.4	472.3	10.4
1925.....	676.4	395.5	331.0	114.5	191.1	26.7	10.0	71.7	41.4	78.6	104.7	729.9	9.2
1926.....	831.0	407.1	324.7	160.8	220.8	23.3	10.2	74.9	36.5	71.4	110.9	819.6	10.3
1927.....	878.4	440.0	335.0	116.7	239.2	33.5	13.9	76.9	47.3	56.6	96.7	749.0	11.9
1928.....	902.7	500.6	289.8	.....	.....	.....	....	92.0	50.7	105.4	115.6	859.8	11.3
Average													
1909-13.....	690.1	197.1	351.8	90.5	147.1	20.1	6.5[a]	71.5	37.8	62.0	158.7[a]	758.9[b]	11.5[a]
1923–27.....	809.5	395.8	344.7	136.3	218.0	27.2	11.5	68.6	35.8	65.1	97.0	638.0	11.1

Year	Morocco	Algeria	Tunis	Egypt	British Isles	France	Germany	Italy	Belgium	Netherlands	Denmark	Norway	Sweden
1920.....	17.9	16.2	5.2	31.7	56.8	236.9	82.6	141.3	10.3	6.0	7.4	1.00	10.3
1921.....	23.2	28.5	9.0	37.0	73.8	323.5	107.8	194.1	14.5	8.6	11.1	.97	12.3
1922.....	12.9	18.9	3.7	36.0	65.2	243.3	71.9	161.6	10.6	6.2	9.2	.64	9.5
1923.....	20.0	35.8	9.9	40.7	58.5	275.6	106.4	224.8	13.4	6.2	8.9	.59	11.0
1924.....	28.8	17.3	5.2	34.2	53.9	281.2	89.2	170.1	13.0	4.7	5.9	.49	6.8
1925.....	23.9	32.7	11.8	36.2	53.7	330.8	118.2	240.8	14.5	5.6	9.7	.49	13.4
1926.....	16.2	23.6	13.0	37.2	52.2	231.8	95.4	220.6	12.8	5.5	8.8	.59	12.2
1927.....	24.6	28.3	8.3	44.3	57.2	276.1	120.5	195.8	16.3	6.2	9.4	.60	11.3
1928.....	22.2	34.0	12.1	37.3	51.1	277.7	141.6	228.6	17.8	7.6	9.0	.68	11.3
Average													
1909–13.....	17.0	35.2	6.2	34.2	59.6	325.6	131.3	184.4	15.2	5.0	6.3	.31	8.1
1923–27.....	22.7	27.5	9.6	38.5	55.1	279.1	106.0	210.5	14.0	5.6	8.5	.55	10.9

Year	Spain	Portugal	Switzerland	Austria	Czecho-Slovakia	Poland	Finland	Latvia	Esthonia Lithuania	Greece	Japan, Chosen	South Africa	New Zealand
1920.....	138.6	10.4	3.6	5.4	26.4	22.7	.27	.39	2.58	11.2	41.1	7.6	6.9
1921.....	145.1	9.3	3.8	6.5	38.7	37.4	.58	.78	3.34	10.3	39.7	8.7	10.6
1922.....	125.5	10.0	2.5	7.4	33.6	42.4	.71	.96	4.17	9.0	39.8	6.3	8.4
1923.....	157.1	13.2	3.8	8.9	36.2	49.7	.69	1.64	3.70	8.8	35.2	6.0	4.2
1924.....	121.8	8.6	3.1	8.5	32.2	32.5	.79	1.58	3.86	7.7	35.3	7.1	5.4
1925.....	162.6	12.1	3.5	10.7	39.3	57.8	.93	2.16	6.08	11.2	40.0	9.2	4.6
1926.....	146.6	8.6	4.2	9.4	34.1	47.1	.92	1.86	5.02	12.4	38.9	8.0	8.0
1927.....	144.8	11.4	4.1	12.0	40.4	54.2	1.06	2.64	6.35	13.0	40.4	6.6	9.5
1928.....	129.6	6.6	4.3	12.1	41.4	53.9	.88	2.61	8.28	15.7	41.5	7.0	....
Average													
1909–13.....	130.4	11.8[c]	3.3	12.8	37.9	63.7	.14	1.48	3.63	16.3[c]	32.0	6.3[a]	6.9
1923–27.....	146.6	10.8	3.8	9.9	36.5	48.3	.88	1.98	5.00	10.6	38.0	7.4	6.3

* Data of U.S. Department of Agriculture. For 1909–13, including U.S. Department of Agriculture estimates for area within post-war boundaries. Dots (....) indicate that data are not available.

[a] Four-year average.

[b] Regarded as too low by Soviet officials, whose estimate is 908 million bushels.

[c] One year only.

TABLE II.—MONTHLY WHEAT RECEIPTS AT PRIMARY MARKETS IN THE UNITED STATES AND CANADA*

(Million bushels)

Month	United States primary markets				Fort William and Port Arthur				Vancouver			
	1925–26	1926–27	1927–28	1928–29	1925–26	1926–27	1927–28	1928–29	1925–26	1926–27	1927–28	1928–29
Aug.	43.3	71.6	81.6	84.2	1.2	1.5	2.4	3.5	.55	.12	.09	1.07
Sept.	57.9	48.7	79.7	73.3	45.7	32.8	8.6	39.1	.28	.29	.32	2.61
Oct.	36.1	37.1	73.3	84.4	53.2	56.1	51.4	81.4	7.04	6.37	6.17	12.69
Nov.	34.1	29.8	44.8	43.6	51.5	60.5	71.0	72.9	9.79	7.22	10.78	14.65
Aug.–Nov.	171.4	187.2	279.4	285.5	151.6	150.9	133.4	196.9	17.66	14.00	17.36	31.02
Dec.	34.9	22.4	26.5	.....	53.5	26.3	41.0	.....	6.14	6.63	11.81	.....
Jan.	21.6	24.6	23.5	.....	10.5	14.0	21.1	.....	10.03	6.83	16.49	.....
Feb.	16.2	21.0	22.5	.....	4.0	8.6	9.5	.....	7.74	4.27	12.54	.....
Mar.	15.1	16.6	26.3	.....	3.2	6.3	3.3	.....	6.98	5.94	10.50	.....
Dec.–Mar.	87.8	84.6	98.8	.....	71.2	55.2	74.9	.....	30.89	23.67	51.34	.....
Apr.	14.0	14.4	18.0	.....	1.8	12.6	.9	.....	3.58	3.58	10.88	.....
May	15.7	19.2	25.9	.....	17.2	17.3	17.6	.....	1.20	1.56	7.43	.....
June	21.0	20.7	15.6	.....	13.6	7.3	20.1	.....	.22	.61	3.66	.....
July	77.0	58.8	72.6	.....	6.4	10.7	14.4	.....	.27	.14	2.44	.....
Apr.–July	127.7	113.1	132.1	.....	39.0	47.9	53.0	.....	5.27	5.89	24.41	.....
Aug.–July	386.9	384.9	510.3	.....	261.8	254.0	261.3	.....	53.82	43.56	93.11	.....

* United States data are unofficial figures compiled from *Survey of Current Business;* Canadian data are official figures from *Reports on the Grain Trade of Canada* and *Canadian Grain Statistics.* Vancouver figures include receipts at Prince Rupert after October 1, 1926.

TABLE III.—WEEKLY WHEAT RECEIPTS AT PRIMARY MARKETS IN THE UNITED STATES AND CANADA*

(Million bushels)

Month	United States				Fort William and Port Arthur				Vancouver			
	1925	1926	1927	1928	1925	1926	1927	1928	1925	1926	1927	1928
July	4.95	8.80	7.65	4.24	1.33	1.95	1.33	4.93	.05	.05	.06	.46
	7.59	13.79	8.54	7.40	1.80	2.04	2.07	4.28	.05	.10	.07	.69
	7.75	14.25	10.35	14.24	1.90	1.63	2.89	3.14	.06	.06	.04	.50
	11.67	19.26	11.35	18.76	1.31	1.19	3.10	3.07	.03	.01	.02	.46
	13.77	25.25	26.01	23.93	.97	.92	2.61	3.03	.03	.05	.00	.72
Aug.	11.04	23.63	24.37	24.87	.38	.75	.95	1.80	.28	.03	.07	.50
	10.15	18.84	19.56	20.18	.23	.22	.81	1.07	.23	.02	.00	.32
	8.98	13.92	16.41	18.56	.24	.21	.35	.76	.02	.02	.00	.22
	8.99	10.89	13.84	15.97	.15	.15	.21	.41	.02	.03	.01	.10
Sept.	11.29	12.92	14.88	15.51	.59	1.12	.20	.43	.02	.06	.01	.09
	13.13	12.47	16.09	15.03	6.20	3.02	.23	.96	.01	.10	.03	.13
	14.15	11.73	19.91	17.67	13.27	6.69	1.01	6.28	.09	.07	.07	.15
	14.99	9.77	19.57	18.36	15.83	12.49	3.00	12.84	.17	.03	.15	.52
Oct.	12.37	9.21	20.07	19.68	16.39	13.51	5.19	16.81	.29	.07	.07	1.42
	9.42	8.71	21.20	22.18	15.73	12.48	11.79	19.37	1.12	.24	.33	2.21
	7.53	7.30	17.52	18.36	10.72	10.82	11.54	19.56	1.86	.75	.36	2.97
	6.19	8.68	14.82	22.75	9.85	13.59	8.71	18.38	1.93	1.90	1.61	3.07
	6.72	9.38	14.03	15.00	10.35	14.37	13.30	17.34	1.64	2.92	2.75	2.68
Nov.	7.95	8.27	14.02	12.30	8.88	12.46	19.27	16.05	2.46	3.33	3.38	3.01
	7.18	7.21	10.24	9.28	10.80	14.16	18.21	15.04	2.53	1.45	2.15	3.59
	8.68	6.59	10.54	8.72	13.67	15.00	14.30	17.05	2.10	.92	2.56	3.58
	8.70	5.86	7.91	10.05	14.42	14.92	15.18	18.37	2.69	1.60	2.12	4.04

* United States data are unofficial figures compiled from *Grain World;* Fort William and Port Arthur data are official figures for *net* receipts furnished by Canadian Board of Grain Commissioners; Vancouver data are official figures compiled from *Canadian Grain Statistics.* United States and Fort William and Port Arthur figures begin with weeks ending July 4, 1925, July 3, 1926, July 2, 1927, and June 30, 1928; Vancouver figures are for weeks ending one day earlier. Beginning October 1, 1926, Vancouver figures include receipts at Prince Rupert.

TABLE IV.—WEEKLY VISIBLE SUPPLIES OF WHEAT IN NORTH AMERICA, UNITED KINGDOM PORTS, AND AFLOAT TO EUROPE, AUGUST–DECEMBER, 1928*

(*Million bushels*)

Date	United States	Canada	U.K. ports	Afloat to Europe	Total	Date	United States	Canada	U.K. ports	Afloat to Europe	Total
Aug. 4	66.8	65.6	9.7	43.6	185.7	Oct. 6	124.5	119.5	7.0	42.3	293.3
11	77.6	56.7	7.4	45.8	187.5	13	131.7	134.8	6.2	41.4	314.1
18	86.4	45.4	7.3	45.5	184.6	20	138.6	141.8	6.0	41.4	327.8
25	92.4	38.1	6.8	44.9	182.2	27	142.4	150.1	5.6	43.0	341.1
Sept. 1	96.8	31.4	9.5	43.7	181.4	Nov. 3	143.0	157.3	5.9	50.2	356.4
8	100.4	32.8	8.0	42.6	183.8	10	142.7	170.3	5.8	54.9	373.7
15	103.8	42.2	8.4	43.8	198.2	17	144.2	176.2	5.2	56.1	381.7
22	111.7	66.8	8.4	41.8	228.7	24	143.5	181.9	5.2	60.7	391.3
29	118.3	92.9	7.4	41.0	259.6	Dec. 1	145.2	184.3	5.7	63.5	398.7

* United States data from *Bradstreet's;* Canadian data from *Canadian Grain Statistics;* United Kingdom and Afloat data from Broomhall's *Corn Trade News.* Canadian figures are adjusted to bring item for western country elevators in correct week, and are for days preceding dates indicated in above table.

TABLE V.—WORLD VISIBLE WHEAT SUPPLIES, DECEMBER 1, 1920–27, AND MONTHLY, AUGUST–DECEMBER 1928*

(*Million bushels*)

Date	United States	Canada	Argentina	Australia	United Kingdom ports	Afloat to Europe	North America	Argentina, Australia	U.K. and afloat	Grand total	Total ex-Australia
1920 Dec. 1	92.2	51.9	.1	6.5	31.6	36.6	144.1	6.6	68.2	218.9	212.4
1921 Dec. 1	107.9	76.6	3.1	6.7	11.1	42.4	184.5	9.8	53.5	247.8	241.1
1922 Dec. 1	125.4	89.3	2.9	10.0	4.5	56.2	214.7	12.9	60.7	288.3	278.3
1923 Dec. 1	139.2	110.5	2.9	1.0	7.8	51.8	249.7	3.9	59.6	313.2	312.2
1924 Dec. 1	168.7	77.1	4.4	2.0	14.3	59.2	245.8	6.4	73.5	325.7	323.7
1925 Dec. 1	109.6	104.5	3.7	.7	3.8	35.1	214.1	4.4	38.9	257.4	256.7
1926 Dec. 1	133.0	123.0	1.8	2.0	3.6	36.9	256.0	3.8	40.5	300.3	298.3
1927 Dec. 1	154.7	120.9	3.6	.7	9.6	57.1	275.6	4.3	66.7	346.6	345.9
1928 Aug. 1	88.1	69.2	5.9	9.5	10.1	44.7	157.3	15.4	54.8	227.5	218.0
Sept. 1	135.9	30.5	8.5	5.2	9.5	43.7	166.4	13.7	53.2	233.3	228.1
Oct. 1	181.8	76.5	7.3	3.4	7.8	41.1	258.3	10.7	48.9	317.9	314.5
Nov. 1	204.4	155.1	7.3	1.3	5.9	50.3	359.5	8.6	56.2	424.3	423.0
Dec. 1	208.0	169.5	4.4	8.0	5.7	63.5	377.5	12.4	69.2	459.1	451.1
Average, Dec. 1											
1910–14	111.7	35.2	.5	.6[a]	18.6	36.0	146.9	....	54.6	.....	202.0
1923–27	141.0	107.2	3.3	1.3	7.8	48.0	248.2	4.6	55.8	308.6	307.3

* A joint compilation by Broomhall, the *Daily Market Record,* Minneapolis, and the *Daily Trade Bulletin,* Chicago; here summarized from Broomhall's *Corn Trade News* and the *Daily Trade Bulletin.* Includes some flour stocks.

[a] Australian figure for one year only.

TABLE VI.—INTERNATIONAL TRADE IN WHEAT AND FLOUR, MONTHLY, JULY–NOVEMBER, 1928*

(*Million bushels*)

A.—NET EXPORTS

Month	United States	Canada	India	Australia	Argentina	Roumania	Hungary	Jugo-Slavia	Poland	Algeria	Tunis	Egypt
July	5.13	35.92	1.19[a]	5.02	9.56	.04	.62	.17	(1.41)[b]	.58	.96	(.44)[b]
Aug.	13.94	29.18	.51[a]	4.43	6.51	.36	2.46	2.96	(.53)[b]	...	1.05	(.74)[b]
Sept.	21.25	30.89	.25[a]	2.79	8.29	.29	2.38	2.03	(.53)[b]	.74	.78	(.73)[b]
Oct.	26.64	48.89	.05	4.55	12.00	...	2.32	....	(.20)[b]	.42	.56	(.75)[b]
Nov.	13.61	80.58	....	....	.....	...	....	....	....	...	....	...

B.—NET IMPORTS

Month	Irish Free St.	United Kingdom	France	Germany	Belgium	Italy	Netherlands	Scandinavia	Switzerland	Czecho-Slovakia	Baltic States[c]	Japan
July	1.37	19.36	3.26	6.96	3.68	8.57	1.71	1.78	1.41	1.33	.64	.63[a]
Aug.	1.42	16.44	4.41	6.67	3.73	5.33	2.25	2.67	1.12	1.57	.88	.45[a]
Sept.	1.77	14.17	5.13	7.71	3.95	5.56	3.52	2.87	1.24	1.88	.90	.43[a]
Oct.	2.08	13.44	4.31	7.15	3.39	7.44	2.52	2.55	1.50	2.52	1.09[d]	.85
Nov.	....	15.92	....	....	....	....	....	....	....	....	....	....

* Data from official sources and International Institute of Agriculture.

[a] Gross, not net. [b] Net import. [c] Finland, Esthonia, Latvia. [d] Excluding Latvia.

TABLE VII.—WEEKLY WHEAT AND FLOUR SHIPMENTS BY AREAS OF ORIGIN AND DESTINATION, AUGUST–NOVEMBER, 1928*

(*Million bushels*)

Week ending	North America	Argentina, Uruguay	Australia	Russia	Danube	India	Other countries	Total	To Europe	To ex-Europe
Aug. 4	9.07	.99	1.11	.....	.04	.17	.80	12.18	10.23	1.95
11	13.23	2.55	1.48	.....	...	.03	1.03[a]	18.32	15.08	3.24
18	11.75	1.16	1.06	.....	.02	.02	1.20	15.21	13.09	2.12
25	10.65	1.43	1.21	.....	.05	...	1.48	14.82	12.03	2.79
Sept. 1	11.36	.83	.97	.....	.07	.04	1.08	14.35	11.22	3.13
8	13.86	1.33	.68	.....	.03	...	.84	16.74	14.00	2.74
15	12.32	1.52	1.02	.....	.10	...	.96	15.92	12.36	3.56
22	11.61	2.67	.28	.....	.15	...	1.16	15.87	12.96	2.91
29	11.41	2.11	.51	.....	.02	...	.86	14.91	11.81	3.10
Oct. 6	13.06	1.54	.26	.....	.31	...	.96	16.13	13.55	2.58
13	9.41	2.09	.59	.....	.04	.02	.85	13.00	10.47	2.53
20	12.86	2.52	1.27	.....	.03	...	1.08	17.76	13.93	3.83
27	12.02	3.65	1.30	.....	.19	...	.88	18.04	13.98	4.06
Nov. 3	15.95	2.18	1.82	.....	.10	...	1.19	21.24	17.38	3.86
10	14.47	3.15	1.00	.....	.12	...	1.02	19.76	16.73	3.03
17	13.81	3.08	.93	.....	.17	...	.89	18.88	15.02	3.86
24	17.07	2.53	.87	.....	.23	...	1.30	22.00	18.24	3.76
Dec. 1	15.42	3.96	1.17	.....	...	...	2.18	22.73	18.15	4.58

* Here converted from data in Broomhall's *Corn Trade News*. Broomhall's weekly figures do not always check with his cumulative totals, which presumably include later revisions. Some wheat actually shipped from the Danube countries is apparently here recorded as shipped from "Other countries."

[a] Includes 30 thousand bushels shipped from Chile.

TABLE VIII.—WEEKLY CASH PRICES OF REPRESENTATIVE WHEATS IN LEADING EXPORTING AND IMPORTING MARKETS, AUGUST–NOVEMBER, 1928*

(*U.S. dollars per bushel*)

Month	United States				Canada		Argentina	Liverpool					
	No. 2 Red Winter (St. Louis)	No. 2 Hard Winter (Kansas City)	No. 1 Dark Northern (Minneapolis)	No. 2 Amber Durum (Minneapolis)	No. 1 Manitoba (Winnipeg)	No. 3 Manitoba (Winnipeg)	Barletta (Buenos Aires)	No. 1 Manitoba	No. 3 Manitoba	Pacific White	No. 2 Winter	Argentine Rosafe	Australian
Aug.	1.44	1.14	1.41	1.15	1.25	1.12	1.26	1.47	1.30	1.41	1.36	1.34	1.44
	1.34	1.05	1.27	1.03	1.20	1.07	1.20	1.44	1.28	1.36	1.26	1.32	1.36
	1.37	1.05	1.25	1.08	1.19	1.07	1.20	1.38	1.24	1.35	1.29	1.24	1.35
	1.37	1.04	1.23	1.09	1.16	1.06	1.18	1.36	1.23	1.34	1.29	1.29	1.34
	1.44	1.06	1.22	1.09	1.17	1.08	1.19	1.38	1.26	1.35	1.28	1.30	1.35
Sept.	1.47	1.06	1.25	1.04	1.15	1.07	1.19	1.37	1.24	1.36	1.31	1.28	1.36
	1.43	1.05	1.23	1.04	1.14	1.05	1.16	1.36	1.25	1.36	1.27	1.26	1.33
	1.45	1.07	1.26	1.07	1.18	1.06	1.17	1.36	1.25	1.38	1.27	1.25	1.36
	1.48	1.10	1.30	1.09	1.21	1.08	1.18	1.39	1.30	1.40	1.35	1.27	1.39
Oct.	1.45	1.10	1.25	1.09	1.25	1.12	1.20	1.46	1.31	1.42	1.36	1.29	1.41
	1.49	1.11	1.24	1.13	1.25	1.12	1.21	1.51	1.38	1.46	1.36	1.34	1.42
	1.47	1.09	1.21	1.08	1.24	1.11	1.21	1.47	1.36	n.q.[a]	1.36[a]	1.33	1.47[a]
	1.38	1.07	1.19	1.15	1.22	1.10	1.18	1.44	1.34	1.42[a]	1.33[a]	1.33	1.46[a]
Nov.	1.40	1.12	1.24	1.21	1.21	1.11	1.18	1.47	1.38	1.44[a]	n.q.[a]	1.33	1.46[a]
	1.41	1.10	1.22	1.14	1.21	1.10	1.18	1.48	1.38	1.42[a]	n.q.	1.33	1.46[a]
	1.46	1.13	1.23	1.10	1.24	1.12	1.18	1.46	1.37	1.42[a]	n.q.	1.32	1.45[a]
	1.45	1.14	1.25	1.18	1.21	1.12	1.18	1.51	1.40	1.43[a]	n.q.	1.33	1.45[a]
	1.45	1.14	1.25	1.16	1.18	1.09	1.14	1.48	1.40	1.44[a]	n.q.	1.32	1.46[a]

* United States prices are weekly averages of daily weighted prices for weeks ending Friday, compiled from *Crops and Markets*. Canadian prices are averages for weeks ending Saturday, compiled from *Canadian Grain Statistics*. Liverpool prices are for Tuesday of the same week, parcels to Liverpool or London, and are from Broomhall's *Corn Trade News*, except Pacific White, No. 2 winter and Australian, which are Friday prices furnished by the International Institute of Agriculture. Argentine prices are averages for weeks ending Saturday, from *Revista Semanal*. No quotation is signified by "n.q."

[a] Tuesday prices from Broomhall's *Corn Trade News*.

TABLE IX.—MONTHLY PRICES OF DOMESTIC WHEAT IN EUROPE, FROM AUGUST 1926*

(*U.S. dollars per bushel*)

Month	Great Britain			France (Chartres)			Italy (Milan)			Germany (Berlin)		
	1926–27	1927–28	1928–29	1926–27	1927–28	1928–29	1926–27	1927–28	1928–29	1926–27	1927–28	1928–29
Aug.	1.76	1.63	1.33	1.61	1.75	1.60	1.85	1.75[a]	1.72	1.75	1.78[b]	1.49
Sept.	1.46	1.43	1.19	1.77	1.57	1.58	2.03	1.73	1.81	1.71	1.68	1.36
Oct.	1.48	1.37	1.24	1.88	1.54	1.61	2.21	1.77	1.89[c]	1.72	1.62	1.38
Nov.	1.62	1.32	1.28	1.96	1.48	1.60	2.20	1.90	....	1.78	1.57	....
Dec.	1.55	1.29	....	1.78	1.58	....	2.31	1.88	....	1.74	1.53	....
Jan.	1.55	1.29	....	1.88	1.58	....	2.13	1.93	....	1.72	1.52	....
Feb.	1.54	1.26	....	1.81	1.56	....	2.11	1.94	....	1.72	1.49	....
Mar.	1.52	1.27	....	1.70	1.65	....	2.11	2.00	....	1.73	1.59	....
Apr.	1.50	1.34	....	1.82	1.74	....	2.02	2.09	....	1.76	1.72	....
May	1.58	1.43	....	1.91	1.87	....	2.16	2.14	....	1.92	1.73	....
June	1.65	1.43	....	1.88	1.85	....	1.99	2.10	....	1.96[d]	1.66	....
July	1.64	1.41	....	1.81	1.76	....	1.80	1.77	....	n.q.	1.60	....

* Data for Great Britain are averages of weekly average *Gazette* prices as given in the *Economist;* for France, averages of Saturday prices furnished directly by Federal Reserve Board; for Italy, averages of Friday prices of soft wheat as given in *International Crop Report and Agricultural Statistics;* for Germany, monthly average prices as given in *Wirtschaft und Statistik*. All data are converted, for convenience, from the domestic currency in which they are quoted in the above sources into U.S. money by monthly average exchange rates. No quotation is signified by "n.q."

[a] Three-week average.
[b] Second half of August.
[c] Two-week average.
[d] First half of June.

TABLE X.—APPROXIMATE DISPOSITION OF WHEAT SUPPLIES IN FOUR LEADING EXPORTING COUNTRIES, 1924–25 TO 1928–29*

(Million bushels)

Item	United States (July–June)					(Canada (August–July)				
	1924–25	1925–26	1926–27	1927–28	1928–29	1924–25	1925–26	1926–27	1927–28	1928–29
Initial stocks	165	135	111	138	142	41	26	35	48	75
New crop	864	676	831	878	903	262	395	407	440	550
Total supplies	1,029	811	942	1,016	1,045	303	421	442	488	625
Net exports	258	95	209	194	155	192	324	292	332	420
Seed requirements	84	82	88	94	90	38	40	39	41	42
Consumed for food	479	492	492	505	507	42	42	43	44	45
Unmerchantable, lost in cleaning, fed on farms	73	31	15	81	94	22	18	31	39	63
Apparent error in crop estimate						—17	—38	—11	—43	
Stocks at end	135	111	138	142	199	26	35	48	75	55
Total disappearance	1,029	811	942	1,016	1,045	303	421	442	488	625

Item	Argentina (August–July)					Australia (August–July)				
	1924–25	1925–26	1926–27	1927–28	1928–29	1924–25	1925–26	1926–27	1927–28	1928–29
Initial stocks	66	56	61	65	70	38	36	30	41	40
New crop	191	191	221	239	250	165	115	161	117	160
Total supplies	257	247	282	304	320	203	151	191	158	200
Net exports	123	94	143	178	160	124	77	103	70	100
Seed requirements	23	25	24	25	26	11	11	12	14	14
Consumed for food	53	54	57	59	61	29	29	30	30	31
Feed and waste	2	10	3	3	5	3	4	5	4	5
Apparent error in crop estimate	...	+3	—10	—31		...	...	...	...	...
Stocks at end	56	61	65	70	68	36	30	41	40	50
Total disappearance	257	247	282	304	320	203	151	191	151	200

* Based so far as possible upon official estimates for the various items of supply and disposition. Estimates for 1928–29 are preliminary. For detailed explanation of our method of estimation and adjustment of items in the disposition table, see notes in WHEAT STUDIES, V, 111f. Crop figures for 1928, except for the United States, are our own approximations.

FEB 23 Rec'd

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 4 FEBRUARY 1929

THE PLACE OF WHEAT IN THE DIET

WHEAT now contributes about one-fourth of the calories of the American diet. It is still the outstanding single staple foodstuff. In most southern European countries wheat contributes a larger proportion of the total calories than in the United States; but in countries where rye or rice is the staple cereal, its contribution is smaller. Its nutritional importance in the United States lies primarily in the starch content, not in the content of protein, mineral elements, vitamins, or roughage.

To consume our wheat as whole wheat bread instead of white bread would make no essential contribution to the national health, and would not be in the interest of national economy, at least if the present American diet continues to prevail. Protein, minerals, vitamins, and roughage are adequately available in other foodstuffs. Nutritional security in the diet is to be sought in the milk supply; and perhaps more than an eighth of the milk supply is secured from mill offals of wheat.

Wheat now ranks as one of the cheapest foods. Per capita consumption appears to be increasing in the world at large, but not in the United States or in Great Britain, Canada, and Australasia. Under present conditions of American prosperity, there is little reason to anticipate increased per capita consumption here.

STANFORD UNIVERSITY, CALIFORNIA
February 1929

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

The central feature of the series is a periodic analysis of the world wheat situation, with special reference to the outlook for supplies, requirements, trade, and prices. Each volume includes a comprehensive review of the preceding crop year, and three surveys of current developments at intervals of about four months. These issues contain a careful selection of relevant statistical material, presented in detail in appendix tables for reference purposes, and in summary form in text tables and charts.

Each volume also includes six special studies bearing on the interpretation of the wheat situation and outlook or upon important problems of national policy. Subjects of issues published in recent volumes are listed inside the back cover.

The series is designed to serve the needs of all serious students of the wheat market, in business, government, and academic circles, by summarizing and interpreting basic facts and presenting current developments in due perspective. The special studies are written not merely for students of the wheat market, but as well for various groups of readers who are especially concerned with the fields discussed.

Volumes I–IV are now available, bound in red buckram, at $10.00 each. The ten issues of Volume V will be published monthly from November 1928 to September 1929, except in April 1929. The subscription price for the volume, including a temporary binder, is $10.00. Individual issues may also be purchased separately. Orders, subscriptions, and other communications should be addressed to Food Research Institute, Stanford University, California; for Great Britain, to P. S. King & Son, Ltd., Orchard House, 14, Great Smith Street, Westminster, S.W. 1, London; or, for continental Europe, to Martinus Nijhoff, 9 Lange Voorhout, The Hague, Holland.

Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.
Published by Stanford University for the Food Research Institute.

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FOOD RESEARCH INSTITUTE

STANFORD UNIVERSITY, CALIFORNIA

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The Food Research Institute was established at Stanford University in 1921 jointly by the Carnegie Corporation of New York and the Trustees of Leland Stanford Junior University, for research in the production, distribution, and consumption of food.

THE PLACE OF WHEAT IN THE DIET

I. INTERNATIONAL BACKGROUND

There is an astounding diversity among different peoples, different classes, and different periods in respect to the place in the diet that is occupied by cereals as a group or by wheat in particular. Under primitive conditions, the character of the diet is largely determined by natural resources and local conditions of production. A pastoral people subsists predominantly on animal products. When it turns to tillage of the soil, the diet becomes more vegetarian. As the stock of capital and technical knowledge is increased, some diversity of the diet can be obtained even in areas isolated one from another. With continuous improvements in transportation and finance, the causes of local peculiarities in the diet exert diminishing influence, and dietaries in different regions, and among different classes, tend to become less diverse. As standards of living rise so that food constitutes a smaller fraction of the total requirement, certain pecuniary causes of dietary diversity diminish. Tradition, custom, prejudice, religious taboos, and the like, many of which originated under sanitary or economic conditions which gave them a practical basis, continue to exert influence long after the conditions have changed; but such factors are in general of decreasing importance in determining the character of dietaries. Uniformity in diets the world over is not to be expected, so great are the influences of climate on production and food requirements, and the influences of shipment costs on relative values. But it is not difficult to envisage a day when the diets of all peoples will resemble one another much more closely than they do today. Similarity of diet involves, however, to some extent, similarity in housing, in clothing, and in social institutions.

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With increases in the population of the world, especially with the development of transportation and trade, the average diet tends to become more highly vegetarian. The cereals, sugar, the starchy roots and tubers, legumes, and the oil seeds all participate in this trend. The reasons are several. Given natural resources will yield larger supplies of food in these forms than in the form of animal products. By and large, animals and animal products are more expensive to ship and store than are most of the vegetable products. Improvements in the science and technique of production make a larger contribution both to the productive areas and to yields for vegetable products than for animal production. But as against this, improvements in refrigeration and in the processing of animal products tend to widen the circle of use of the foodstuffs which are otherwise highly perishable.

The several vegetable constituents of the diet differ in their susceptibility to increase. The sugar resources of the world are already highly developed. By contrast, the oil-seed resources and trade are in a comparatively early stage, and it is their increasing competition with certain animal products that constitutes one of the larger food problems of the present day. Expansion in the use of starchy roots and tubers is limited by transportation costs, though there is the possibility that with advances in technique these obstacles may be partially overcome. Cereal culture and trade stand on a fairly high level of development, but have by no means reached either extensive or intensive limits.

Cereals constitute the outstanding fuel food. A people with a high incidence of sedentary occupation, or living in a warm climate, other things being equal, will con-

sume less of cereals than a people living in a cold climate or heavily engaged in arduous occupations. Circumstances and prices determine in what proportions cereals, sugar, or fats are used as fuels. Other things equal, moderate workers prefer carbohydrate to fat; heavy workers incline to fat in order to reduce the bulk of the diet.

Since dietary habits differ so greatly throughout the world from a great diversity of causes, to describe with precision the general position either of the cereals as a group or of wheat in particular is practically impossible. Yet certain broad statements, especially with respect to trends in consumption, may be helpful as an introduction to the subsequent discussion.

Trends in Cereal Consumption

Trends in cereal consumption are not clearly discernible in Asia and the adjacent islands. Though wheat is nutritionally superior to sorghum grains, the latter yield more heavily per acre. The use of rice is supported by custom, preference, and shortage of fuel. In some areas land is being taken from rice and devoted to the growing of industrial raw materials. Apparently, the potato is just beginning a successful invasion of China and India, being well adapted to large regions in those countries. To Asiatics, legumes are superior to wheat as a source of protein. The populations involved are so large, the diversities between regions so pronounced, transportation is so undeveloped, the security of commerce so inadequate, and numerous other factors are so imponderable that precise characterization is impossible of the trend in Asia, either in the use of cereals or in the position of wheat. All that can be said is that in certain coastal areas a trend in favor of wheat seems discernible.

Nor is a trend readily discernible in Europe. The losses of agriculture during the war, the financial and other impediments to reconstruction of agriculture since the war, the depreciation of currencies, parcellation of large estates, and the establishment of new frontiers, have combined to obscure the developments of agriculture in Europe. With diminution of purchasing power, Europe might well seek a cheap food supply, which would favor the expanded use of cereals. But the urban classes insist on animal products; also the trend of agriculture is toward animal husbandry and away from cereals. Whatever the situation with the cereals as a class, there can be no question that wheat is replacing rye and corn as breadstuff in Europe; and in Caucasian countries generally, consumption of sugar has for several decades tended to increase at the expense, presumably, of cereal consumption.[1]

Of the cereal foodstuffs, wheat is quite the most important. Rice, rye, corn, and sorghum grains are more important in certain regions, some of them maintaining large populations; but generally wheat is preferred over all of these except rice. There seems to be no doubt that, in the world at large, wheat is being consumed in increasing amounts, and that it tends to gain at the expense of other cereals. Broadly speaking (disregarding Asia), it appears that per capita consumption of wheat is tending upward except only in those countries, regions, or classes where other cereals have already been relegated to a minor position, and where the standard of living is such as to permit a diversification of the diet which leaves wheat a smaller place. This is probably the case in the United States, Great Britain, Canada, and Australasia, but in few other countries. To some extent the increasing mechanization of human activities, improvements in housing and heating, and other factors have reduced per capita requirements of food-fuel; but such reduction in requirements is not yet sufficiently general and important to offset other tendencies toward increased per capita consumption.

Increase in total world consumption, or disappearance, of wheat (outside of seed) may be in one or all of four directions:

1. Increase in population of wheat-consuming countries.

[1] Definitive opinions on the trend of cereal culture of the world would best be deferred until after the censuses to be taken in practically all countries in 1930. Unusual preparations have been made for a world-wide census of agriculture, with the reports planned to be on a more comparable basis than has ever occurred before. The forthcoming census is not only highly important on account of improvements in census procedures, it is especially important because the census of 1920 was so unsatisfactory, following directly after the close of the war.

2. Increase in per capita consumption in wheat-consuming countries.

3. Increased use of wheat as animal feeding stuff and in industry.

4. Penetration of wheat into countries not now, or only in part, wheat-consuming regions.

The statistical material at our disposal does not now permit of segregation and measurement of these four directions of increase. The rate of increase of population is only approximately known for most countries. The difficulties in judging consumption are enhanced by the unsatisfactory state of the statistics of production. Nevertheless, one is justified in assuming that, for the world as a whole, consumption of wheat tends to increase. Population grows, though at a rate not accurately to be appraised. Per capita consumption, at least in post-war years, tends on the whole to increase, though not in all groups of peoples and not uniformly. The use of wheat is apparently expanding, both absolutely and per capita, in countries where wheat plays a relatively small part in the diet. Statistically, little is known of the use of wheat for animal feed and in industry; but nothing suggests that this use is tending to contract. One may properly assume that the general trend of wheat consumption is upward, but at what rate it is impossible to say.

The question naturally arises whether supply precedes demand or demand precedes supply in the trend of expansion of wheat growing in the world. Are opening of new wheat land and improvement in yield and quality the primary factors? Or is the expanding demand of old wheat eaters and new wheat eaters the primary factor in stimulating production? In a certain sense such a question is both hypothetical and artificial; but if one poses the question as it ought to be considered for any commodity, it seems that increase in supply, with improvements in facilities of transportation and international exchange, is primary. Wheat has long been regarded as the premier cereal, except with certain rice-eating peoples. New purchasers of wheat can always be secured when an enlarged production enables wheat to be offered at a price regarded as competitive in communities accustomed to the use of several cereals. In this sense, it is to be said that the place of wheat in the diet of the world is expanding, and that the rate of expansion depends primarily upon factors of supply and price.

II. WHEAT IN THE FOOD SUPPLY OF THE UNITED STATES

Quantitative Importance

Discriminatingly to appraise the importance of wheat in our diet, we must consider the intake of wheat and of other cereals, and the total ingestion of foodstuffs.

A forward-looking segregation of the food supply is to divide it into six classes, a grouping based largely on attributes rather than on derivation. This classification, though conveniently applied in the United States, is not as useful in judging the food supply of this country as in appraising the food supply of the world. Nevertheless, it may serve an introductory purpose on the present occasion.

1. Animal products, including milk, butter, cheese, beef, mutton, pork, poultry, fish.

2. Cereals, including wheat, rye, maize, barley, oats, rice, sorghum grains, and divers other seeds.

3. Tubers, roots, and stalks, including cane sugar, beet sugar, potatoes, cassava, sago, tapioca.

4. Oil seeds, including coconut, peanut, walnut, almond, pecan, cottonseed, olive, sunflower seed, palm and palm kernel, sesame seed, rape seed, flaxseed, and soy bean.[1]

5. Legumes, including peas, beans, lentils, pulses of all kinds.

6. Fruits and vegetables of all kinds, outside of the above.

Employing figures of Pearl[2] for the six crop years 1911–12 to 1916–17, slightly adjusted and rounded, we have the following rounded percentages of the total calories

[1] Soy bean is a legume, but is classed with the oil seeds on account of its high fat content.

[2] Raymond Pearl, *The Nation's Food* (Philadelphia, 1920), pp. 252–57.

contributed to the American diet by these six classes of foodstuffs:

CLASS	PER CENT
Animal products	40
Cereals	34
Tubers, roots, and stalks	17
Oil seeds	5
Fruits and vegetables	3
Legumes	1

The figures are based on food purchased for use and thus include both ingestion and household waste.[1] Since waste is not uniform in the different groups, the figures for ingestion would be sensibly different, but the point does not concern us here. The figures are only approximate, but are nevertheless probably fairly illustrative of the diet of the period 1911–17. A similar analysis of the present diet would probably show some decrease in cereals and some increases in dairy products, sugar, and fruits and vegetables; but the changes cannot readily be measured and are not, for the most part, radical in character.

[1] Inedible refuse and waste have been subtracted, but edible waste in the foodstuffs as produced is included in consumption.

[2] Raymond Pearl, *op. cit.*, pp. 247–48.

[3] In the statistical estimates of the food requirements of a country it is customary to recalculate the mixed population of men, women, and children into units of average adult men. One first determines the customary food requirements of each sex at different ages. Then one obtains the census figures for total population, age distribution, and sex distribution. From these data one then computes the number of average statistical adult males in the population. According to the census of 1919, in the United States 100 census individuals corresponded to about 85 average statistical adult males.

[4] The word disappearance is in some ways better than consumption to express the disposition of food. Broadly considered, disappearance includes all ways in which a supply is reduced. Pearl attempted to make a separation between consumption (including ingestion and edible waste) and ingestion following adjustment for edible waste. This gave the following material for daily per capita consumption, which illustrates how large are the items of waste, particularly for fat and carbohydrate:

	Ingestion and waste	Ingestion
Protein (*grams*)	121	114
Fat (*grams*)	169	127
Carbohydrate (*grams*)	542	433
Total calories	4,290	3,424

When one regards these estimates of edible waste and considers also the inevitable errors of sampling and analysis, it becomes clear how unwarranted it is to set up supposedly precise figures for intake of protein, fat, and carbohydrate.

Of the total calories in the diet contributed by cereals (34.7 per cent unrounded), 25.9 per cent were derived from wheat and 8.8 per cent were secured from all other cereals. From this computation it would appear that fifteen years ago a little over one-fourth of the calories in our diet was secured from wheat. The figure is of course by no means exact, because the error in the estimates of total calories is much larger than the error in the estimation of the calories in wheat.

According to Pearl's calculations,[2] the food supply of the average adult male[3] American corresponded to 4,290 calories per day, for the period 1911–12 to 1916–17, this including ingestion and waste in the household.[4]

The nutritional components were 542 grams of carbohydrate, 121 grams of protein, and 169 grams of fat. Of the total, cereals contributed 1,489 calories, or 34.7 per cent. Cereals stood second in order of magnitude; animal products stood first with 1,705 calories, or 39.7 per cent. Sugar stood third with 568 calories, or 13.2 per cent. In a contrast of these data with those of other countries, the outstanding features are the large figures for animal products and sugar and the small figure for cereals.

Rounded figures given in Table 1 show the approximate position of cereals and of

TABLE 1.—CEREALS AND WHEAT IN DIETS OF VARIOUS COUNTRIES BEFORE THE WAR*

Country	Percentage of total calories in cereals	Percentage of total calories in wheat	Percentage of total cereals in wheat
United States	34	26	75
Great Britain	35	31	89
Germany	39	16	40
France	55	50	91
Italy	64	47	73
Russia	73	19	26
Japan	87	6	7

* These figures apply to the years just before the war and were secured from compilations carried out during the war, largely for the purpose of determining the basis of rationing. Comparable figures for the same countries since the war are not available. Cf. T. B. Wood, *The National Food Supply in Peace and War* (Cambridge, England, 1917); *Rapport Général, Commission Scientifique Interalliée du Ravitaillement* (Paris, 1918); *Die Deutsche Volksernährung*, edited by Paul Eltzbacher (Braunschweig, 1915); Carl Ballod, "Die Volksernährung in Krieg und Frieden," *Schmollers Jahrbuch*, XXXIX, 1915.

wheat in the pre-war diets of various countries.

The ascending percentage of the total calories contributed by cereals is strikingly shown. The low figure for wheat in Germany was due largely to the use of rye and potatoes and in Russia to the use of rye. The low figure for wheat in Japan was due to the use of rice. Probably the figures for cereals for Russia and Japan were too high. Except for the proportion of wheat to all cereals, the diets in the United States and Great Britain were similar. Conditions in Australasia and Canada resembled those in Great Britain and the United States.

In the pre-war diet of the average statistical adult male American, cereals contributed 56.1 per cent of the carbohydrates, sugar ranking second with 25.6 per cent. Striking are the low figures for legumes and for fruits and vegetables, illustrating how small is the contribution of carbohydrates by legumes and all the fruits and vegetables including the potato.

In the pre-war diet of the average statistical adult American male, cereals contributed 43.5 grams of the total of 120.7 grams of protein per diem, or 36.0 per cent. Animal products stood first with 67.4 grams, or 55.8 per cent. Striking is the low figure for protein contributed by legumes, 2.3 grams, corresponding to 1.9 per cent of the total. Nowhere else in the world (Eskimos and such peoples excluded), outside of Australasia and Canada, is such a relation between animal protein and cereal protein to be observed; it is just the converse of the common relationship in other countries, where the cereal protein exceeds the protein of animal products, usually by a heavy margin.

The pre-war diet of the average statistical adult American male contained 168.9 grams of fat per day, of which animal products contributed 140.2 grams, or 83.0 per cent. From oil seeds were secured 20.6 grams, or 12.2 per cent, while cereals contributed only 6.7 grams, or 4.0 per cent. Contrasting the carbohydrate and fat contributed by cereals, we realize how predominatingly starchy they are and how insignificant is the content of fat. Incidentally, outside of Australasia and Canada, no region approaches the United States in fat ration, except near the poles where marine fats predominate and in the tropics where the vegetable oils predominate in the diet.

According to Pearl, of the 1,489 calories contributed by cereals to the daily food supply of the average statistical adult American male, 1,112 were in wheat. The wheat calories were roughly 75 per cent of the total cereal calories, and represented 25.9 per cent of the calories in the food supply.

Thus, of the total carbohydrate of the diet, wheat contributed 42.3 per cent; of the total protein, 28.9 per cent came from wheat; of the total fat, only 1.8 per cent came from wheat.

According to the recent estimates of the Food Research Institute, the per capita flour consumption is now about 0.9 barrels per annum.[1] Converting the per capita figure into that of the statistical adult male to make it comparable with the pre-war estimate of Pearl, this corresponds to 950 calories per day per statistical adult male in the form of wheat flour. This includes semolina going into alimentary pastes but does not include breakfast foods. The census reports on the manufacture of wheaten breakfast foods since the war lead to the rough estimate of 15 calories per statistical adult male per day consumed in this form.[2] The total, 965 calories, is to be contrasted with 1,112, the figure reached by Pearl, and represents a substantial reduction. If one were to assume that the total calories of the food supply per statistical adult male are now the same as computed by Pearl for the pre-war consumption, 4,290, it would follow that the wheat calories now represent but 22 per cent of the total calories of the food supply as bought. The low figure for wheat calories would seem to confirm the worst fears of the wheat grower and flour miller.

What, now, is the present food requirement of the statistical adult male? The figure of 4,290 calories including intake and waste is much too high—in the opinion of the writer 400–500 calories too high. Undoubtedly the intake of food has been declining, with decrease of manual labor, re-

[1] See WHEAT STUDIES, July 1926, II, 267, 279.

[2] Corresponding to 6,437,510 bushels of wheat reported as used in food preparations outside of flour mills. But flour mills also manufacture breakfast cereals.

duction in number of exposed occupations, improvements in housing, and average reduction of body weight. At the time when the food requirements of the allied nations were set as the basis of the program of provisionment, a safe figure for the caloric requirements of the statistical adult male was set at 3,000 calories per day. This corresponded to a per capita requirement of practically 2,500 calories per day. More recent estimates are substantially lower—indeed, it may not be much in excess of 2,000 calories per day per head of population.

If, now, the per capita ingestion of flour be taken at nine-tenths of a barrel, this would correspond to about 790 calories per day. If the total per capita ingestion be only 2,000 calories, then the flour calories would amount to 39 per cent of the total. But if the total per capita ingestion be 2,500 calories, then the flour calories would amount to but 32 per cent of the total.

Two things are rather surprising in this connection: first, the indefiniteness of our statistical information on average per capita supply and ingestion; second, the large figure for waste to be applied in any computation of the American food supply. This waste begins at the farm and continues through to the dining table, where it is peculiarly prominent. In fact, service waste and plate waste are peculiarly American defects. In no way are the luxurious habits of Americans more clearly revealed than in the wastes attending the preparation, the table service, and the table ingestion of foodstuffs.

Forms of Ingestion of Wheat

Wheaten products are used in this country in five ways: as yeast-risen bread and quick-rising bread; as crackers, cakes, and pastries; as flour used in sauces and gravies and in the preparation of meat and vegetable dishes; as alimentary pastes, in the various forms of noodles, macaroni, spaghetti, ravioli, and vermicelli; and as breakfast cereals. It is surprising how little we know of the several amounts of wheat that go into these five classes of foodstuffs.

Yeast-risen bread, of course, is the outstanding form in which wheat is ingested, but what proportion of domestically consumed flour goes into bread is not known. One-half looks too low, four-fifths looks too high; probably one might guess somewhere between two-thirds and three-fourths. How much of the bread is baked in the home and how much purchased from bakeries remains curiously indefinite. The reports on purchase of flour by bakeries, as issued in the successive biennial censuses of manufacture since the war, give figures far below the estimates of millers and bakers, even when allowance is made for omission of reports of small bakeshops. Undoubtedly, bakery bread is superseding home-made bread, but how rapidly and to what approximate extent is not clear.

There has been an evident increase in the use of cakes, pies, and pastries, but it is not measurable; nor is it clear to what extent home-baked sweets are being replaced by the baked sweets of the shops. It seems probable that the increase in the use of cakes, pies, and pastries has been in part, possibly largely, at the expense of bread. In the use of baked sweets the price of flour is less important than in the case of bread.

The amount of flour used in sauces and gravies and in the preparation of meat and vegetable dishes cannot be large. In some ways, the development of home cooking under the influence of instruction of girls in home economics tends to favor such use of flour; but the preference for broiled meats is against it.

Alimentary pastes have become more popular in the diet, and they are now widely used even outside of the Latin populations in whose cuisine they are prominent. Alimentary pastes are prepared both from durum wheats and from bread wheats. In the trade, estimates of the wheat equivalent of the semolina used in alimentary pastes used in the country run from 20 to 30 million bushels; but the data are unsatisfactory in all directions, partly because pastes are made in small shops as well as in large factories. Also, it must be kept in mind that some durum flour goes into bread.

The amount of wheat used in breakfast cereals is not large and has not been shown to be increasing. There is certainly more consumption of toasted wheat bread than of wheaten breakfast cereals at the breakfast table. There are several prominent wheaten breakfast foods, but they find dif-

ficulty in increasing their trade in competition with preparations of corn and oats. To the making of breakfast cereals, gruels, and porridges, wheat lends itself in some ways less well than oats, corn, and rice, though better than rye and barley. Indeed, gluten may be a disadvantage in a breakfast cereal. Shredded wheat, puffed wheat, and cream of wheat are outstanding breakfast foods that have held public favor for many years; but there are preparations of oats and corn of equal if not greater prominence. According to the census of 1925, "food preparations" of wheat accounted for but 6,437,510 bushels of wheat, compared with 26,474,963 bushels of corn and 38,397,051 bushels of oats. But such a figure is too low for breakfast cereals because of the widespread use of bran in various cereal mixtures.

Any substantial gain or significant loss in use of wheaten foodstuffs is likely to apply largely to bread. When times are hard, more bread is likely to be eaten and less of cakes and pastries; with prosperity, the intake of wheaten bread is likely to be cut down and the use of cakes and pastries increased. In public eating places bread is often served free, but cakes and pastries are not; when the service of bread is charged for, this tends to lower consumption in public eating places. When wheaten breakfast foods or cakes and pastries are introduced into the meal, this is a selection; but the use of bread is largely an incident. Bread is a carrier for other foodstuffs, whose use rises and falls with any individual, depending upon the other components of the meal. The use of bread as a staple in the meal, an integral part of it like an order of meat, is peculiarly ill-defined on the American table of today.

It is to be kept in mind that to a substantial extent the different forms of wheaten products compete for the attention of the consumer. It is toast versus breakfast cereals; roll versus coffee-cake; spaghetti versus bread; and so on. Thus the drives in favor of consumption of wheat in one form have some effect on the use of wheat in other forms.

Bakers have learned that variety is the spice of life, and bread is now offered in a multiplicity of styles and made according to different formulas. Increasingly the custom in public eating-places is to offer patrons a choice of breads; the breads of wheat, rye, and corn are often heaped together on the bread plate. The same use of variety is shown in the multiplicity of cakes and pastries offered in public eating-places. The breads containing fruits and nuts spring from the same motive. Undoubtedly, the appeal to the consumer has thus been heightened to some extent, and bread thus raised from the drab position of an unchanging staple. Did the present-day American have available only the breads, cakes, and pastries of his forebears, the consumption of wheat would have declined more than it has. The wrapping of bread and frequent delivery of wheaten products has aided the bakeries in replacing home-baked products; this has probably tended also to increase consumption, as compared with the use of home-baked products. But the increased cost through wrapping and delivery may have tended slightly to restrain consumption.

The relation of the price of bread to the price of flour, and to the prices of other baked wheaten foods, depends, apart from expenses of distribution and selling, upon the inclusion in the bread of other ingredients than flour. In Europe the standard bread is baked of dough containing only flour, salt, yeast, and water. In this country the standard bakers' formulas include shortening, milk, and often sugar or malt extract. European-type bread is still baked for our foreign population and French bread is served to some extent in public eating-places; but the prevalent American taste is emphatically in the direction of the bread whose texture and taste are modified by the addition of the other named ingredients. In Europe bread is much cheaper than cakes and pastries; in this country the relative difference is less pronounced.

There is much discussion on the digestibility of the different cereals, and of different preparations of the same cereal, most of which is not to the point. The digestibility of the milled preparation of any cereal depends upon the degree of extraction,[1]

[1] By extraction is meant the proportion of the wheat berry recovered in the flour or other milled product.

the fineness of grinding, the proportion of fiber, and the method of preparation for the table. In all probability, the comparative digestibility of the different cereals rests upon the same factors. This would imply that comparable flours of the same cereal or of different cereals, comparably prepared for the table, would be comparably digestible. In short, the question is not one of the digestibility of the digestible elements but is a question of the varying effects of the indigestible elements.

III. WHEAT AS A SOURCE OF NUTRIENT MATERIALS

The nutritional factors in the diet are the carbohydrates, the fats and oils, the proteins, the mineral salts (or, more technically, the cathions and anions), the vitamins, and the roughage. In appraising the place of any foodstuff in the diet, one does so with reference to its constituents in relation to the nutritional requirements of the diet as a whole. To appraise the importance of any *one* foodstuff, one must have regard for the *other* foodstuffs in the diet to which the one in question is complementary or supplementary. In discussions of the physiology of nutrition, one must not rigidly separate the various factors concerned; nutrition is not a series of disconnected compartments. But in a discussion of the place of any foodstuff in the diet, it is convenient to resolve the foodstuff into the several factors, with the caution that the reader must not take the segregation too literally. How is the place of wheat in the diet to be appraised from the standpoint of its nutritional constituents in their relations to the constituents of the diet obtained or obtainable in other foodstuffs?[1]

Wheat as a Source of Carbohydrate and Fat

Since wheat contains around 70 per cent of carbohydrate, and wheat flours from 69 to 73 per cent, wheat represents the most important source of carbohydrate in the diet. The carbohydrate is almost entirely starch, except for cellulose in the coat of the kernel. The concentration of starch is highest in the endosperm, where the fiber is lowest; the relations are reversed in the bran. On digestion, dextrin and maltose appear first, later glucose; a complete digestion converts the starch into glucose entirely.

[1] For an excellent popular presentation see C. O. Swanson, *Wheat Flour and the Diet* (New York, Macmillan, 1928).

The carbohydrate contained in the wheat content of the average American diet corresponds to 42.3 per cent of the total carbohydrate of the diet and represents 22.5 per cent of the total calories of the diet. Wheat is therefore the outstanding fuel food. In the hard-working classes in countries with a more vegetarian diet, the cereals are used as fuel much more than in the United States. To an extent equaled nowhere else in the world, we employ fats, sugar, and meat as fuels in place of carbohydrates. But wheat is still the chief single fuel.

The digestibility of the carbohydrates of wheat is highest in the endosperm and lowest in the coat. The cellulose of the bran and the fiber in the flour are practically not digestible at all; the digestible starch in the bran is protected by the fibrous elements and to some extent escapes digestion. Therefore the digestibility of the starch of different flours is reduced as the extraction rises and it is facilitated by the comminution. There has been a great deal of discussion as to the relative digestibility of different wheaten flours; in all probability, the fineness of the grinding and the extent of extraction explain the differences found in digestion tests. Raw starch is less digestible than cooked or baked starch; and to a considerable extent the digestibility of breads is dependent upon the physical characteristics of the loaf, the amount of water taken up in the dough, and the amount of shortening employed. The best white breads are considerably more digestible than the best whole wheat breads; indeed, whole wheat breads are preferred by some simply because of the large and indigestible residue.

Cereals, with few exceptions, are poor in fatty substances. Wheat contains from 1 to 2 per cent of crude fat, much less than corn and oats. Thus, the wheat fat furnishes less than 1 per cent of the calories of wheat

flour. The fat is largely in the germ; rancidity of the fat is the most obvious expression of decomposition of whole wheat flour containing the germ. The fat is of little nutritional importance, so far as is known, and the intake of fat in wheat corresponds to only 1.8 per cent of the fat content of the American diet. The fat of the germ is the carrier of two vitamins—A and E; wheat germ fat is, indeed, the best known source of vitamin E.[1] Outside of the commercial importance of the fat as the basis of decomposition, the fat of the wheat has no known practical significance in nutrition outside of its fuel value.

Combining the carbohydrate and fat of wheat, we obtain the factor which gives to bread its outstanding position as a fuel food. Taking the per capita consumption of flour as nine-tenths of a barrel of average analysis, the wheat flour contributes close to 800 calories per person per day, the largest contribution of any single foodstuff. Of this, some 670 calories are contributed by the carbohydrate and the fat and some 130 calories by the protein.

Wheat as a Source of Protein

A people must secure protein for the most part either in cereals, legumes, or animal products. Americans secure their protein largely from animal products and cereals, only to an insignificant extent from legumes. In most parts of Asia, on the contrary, protein is secured largely from legumes and cereals, to a small extent only from animal products. The European diet stands nearer to the American than to the Asiatic diet, in total intake of protein and in dependence on animal products for protein rather than on legumes and cereals; the total protein intake is lower than in the United States, but higher than in Asia.

Protein is burned in the body like any other nutrient and is, therefore, a source of energy.[2] A small amount of sugar is known to be formed from protein; and from this sugar, fat may subsequently be formed. But these are subsidiary reactions and do not express the importance of protein in the diet of normal persons.

Protein is composed of amino-acids, which serve for the growth and maintenance of the tissues of the body. They are often termed the "building-stones" of the tissues. The number of amino-acids in protein is large—nearly 20; all of them are not equally important, because some may be formed in the body, while others cannot be so formed and must be supplied in the diet. We speak of a protein as "competent" or "balanced" when it contains the amino-acids, the "building-stones," necessary for the tissues; we speak of it as "deficient" when certain of the indispensable amino-acids are absent. Balanced and deficient protein are relative terms. The best proteins for use in the body are contained in milk, in eggs, and in the edible visceral organs. The proteins of the skeletal muscles, the common meat of our table, are less competent. Still less competent are the proteins of cereals which, as a class, are inferior to the proteins of legumes, some of which indeed are competent. Among the cereals, the protein of corn is perhaps the poorest, which explains why supplementary feeding with protein concentrates is so important when raising hogs on corn. Wheat ranks relatively high in the nutritional quality of its protein, but is relatively poor in two indispensable amino-acids, lysine and tryptophane.

As a source of protein, wheat stands above most of the other cereals. Oat meal, it is true, ranks as high in protein content as wheat flours; but the milled preparations of corn, rye, barley, rice, and sorghum grains run in protein content from one-half to three-fourths of the protein content of hard wheat flour. Some of the softer wheats, however, yield flours containing no more protein than the other cereals. The point is of little importance in this country. The protein content of wheat is a matter of significance to vegetarians; also, in other groups it is important. In a diet heavy in cereals and light in legumes or animal products, a heavy content of protein in any grain would be an asset; but with the prevalent heavy protein intake in the American diet, the extra protein of wheat has little use but as fuel and is there-

[1] See below, p. 159.

[2] A part of the heat set free when protein is burned is utilizable only for warmth of the body and not for support of work.

fore comparable with the corresponding amount of starch. Indeed, by some who regard our protein intake as excessive, the protein of wheat is regarded rather as a disadvantage, so long as we consume so much animal protein.

Judged by animal experiments, all cereals are incomplete foodstuffs. But conclusions drawn from the behavior of animals fed solely with one cereal find no application to the use of the cereal in a mixed diet. Nutritionally, wheat protein has not been shown to present any advantages, other things being equal, over the proteins of rye, oats, barley, or rice, in a mixed diet. If the cereal in the diet is important as a source of protein, then wheat is better than corn and probably better than rice, rye, and barley, but perhaps not as good as oats.

The proteins of cereals are all more or less unbalanced and incompetent. This is a defect only when cereal protein predominates heavily in the diet. Where a food supply contains only 36 per cent of the protein in the form of cereal protein, the unbalanced nature of such protein has little importance. Indeed, it is easily possible to have cereal protein constitute two-thirds of the total intake if the remaining protein is adequately balanced, e.g., if it is drawn from meat and milk.

Thus, the importance of the quality of the protein of a cereal depends upon the proportion of that protein in the total protein of the diet. In the case of wheat in the statistically average American diet, its protein is only around 29 per cent of the total ingestion of protein. Human experience and experiments on animals make it clear that with the appropriate use of milk and meat, wheat could be depended upon for half of the protein of the diet without approaching the danger line. Under these circumstances, the nutritional quality of the protein of wheat has little practical bearing on our diet, except for vegetarians and underfed persons.

The protein of the germ and coat is somewhat superior to that of the endosperm. If bread were a crucially important source of protein and if the protein of whole wheat bread were crucially superior to that of white bread, then it would be important to use whole wheat bread instead of white bread as the source of protein. But this is not the case; and incidentally, the protein of the customary white milk-bread is superior to that of whole wheat bread.

The outstanding advantage of wheat protein lies in the gluten, which adapts wheaten flour to the making of yeast-leavened loaf bread. By virtue of the gluten, wheaten bread may be mixed, kneaded, baked, wrapped, and delivered at low cost with the methods of mass production. This commercial advantage is not detracted from by demonstrable nutritional disadvantages. Whether baked preparations of oats, barley, corn, and rice—biscuits, scones, cakes, pancakes, steam bread, or other forms—are less digestible than yeast-risen wheaten bread is not definitely known. Much depends upon the varying excellence of different preparations. In all likelihood, the difference in digestibility in properly made preparations of the different cereals is inconsequential in a mixed diet.

Wheat as a Source of Mineral Elements

The animal body contains certain mineral elements: of importance here are calcium, sodium, potassium, magnesium, and iron of the cathions; and phosphorus, sulphur, chlorin, iodin, and fluorin of the anions. These elements exist in varying combinations and proportions in the skeleton, in the fleshy tissues, in the circulating fluids, and in the coverings of the animal body. The requirements are relatively heaviest during the period of growth; the maintenance requirements are, however, considerable. For no one of these substances can the rate of requirement for growth or maintenance be stated upon a quantitative basis per day, per week, or per year. But whatever the requirements, these substances must be introduced with the diet. As a rule, too much is better than too little, though this is not the case with the iodin, which has a peculiar influence on the activities of the ductless glands.

These inorganic elements, varying from element to element, are present in all natural foodstuffs, varying from product to product. In the refining of sugar, the mineral elements present in the juices of the cane and the beet are eliminated. Also, in the rendering of animal fats and

oils and in the refining of vegetable fats and oils, the mineral elements are practically eliminated. There is little loss of mineral elements in the commercial canning of fruits and vegetables, except with certain processes. In the curing of animal products on the other hand, mineral salts are usually added. In the milling of grains for the production of bolted flours, the content of mineral salts is reduced.

It has long been urged, as a part of the whole-grain doctrine, that the cereals of the diet should be milled whole in order to retain all the mineral elements. In all cereals, the deposition of mineral elements is larger in the coat than in the endosperm; and the distribution of the different elements is different in coat and endosperm.

During the growth of the child, the turnover is rapid in the mineral metabolism. Something more is involved than the deposition of mineral elements in the skeleton; there is also a metabolic turnover, in which the mineral elements are taken into the body and eliminated with the excrementa. In the forced feeding of young animals for market, it is now established practice to add a mineral ration, since it has been found that animals raised on corn grains, plus protein concentrates like tankage, even with the inclusion of green feed lay on flesh faster if given a supplementary mineral ration.

So far as human beings are concerned, our information on deficiency in mineral elements seems to be limited to calcium, phosphorus, iron, and iodin, of which the latter may be disregarded since cereals are not a source of iodin. The deficiencies involving calcium and phosphorus (also possibly fluorin) are connected with the skeleton and the teeth. The defects include imperfect structure formation, defective deposition of salts, fragility of the bones and teeth, and decay of the teeth.

The question arises to what extent these deficiency conditions are due to shortage in calcium and phosphorus, rather than to disturbances in the processes of deposition in the bones and teeth. A skeleton may be structurally weak in substance because lime and phosphate were not available; or it may be weak in substance because, with the mineral elements freely available, the bone-building tissues did not function normally. For illustration, there is a disease associated with deficiency of haemoglobin in the red cells of the blood; is this due to lack of iron or to inability of the haemoglobin-forming tissues to build haemoglobin even when iron is available? The same question applies to the bones and teeth—are the defects due to scarcity of the inorganic elements or to improper working of bone- and tooth-building functions, even when the mineral elements are freely available?[1]

For the United States, it is to be concluded that defects in bones and teeth, so far as they are of dietary origin, are due predominantly not to shortage of mineral elements but to disturbances of function associated with shortage of vitamins, and are provoked also in other ways.

If it were desired to avert a possible deficiency in mineral elements, do the cereals offer the best method of achieving this? The cereals show no outstanding superiority in mineral equipment. Calcium and phosphorus are not present in cereals in the proportions best adapted for use in the skeleton; also the potassium is greatly in excess of the sodium, the magnesium greatly in excess of the calcium. The mineral salts in milk, in fruits and vegetables as a class, and especially in the leaf vegetables, are better proportioned to the needs of the animal body. Medical experience in the rearing of children, and experiences of animal husbandry in the rearing of animals, agree in the view that the mineral elements in cereals are not ideally proportioned and are not to be relied upon for the best development of the body.

Coming, now, to the mineral elements in white flour and whole wheat flour respectively, the flour is lower in mineral elements than is the wheat offal; indeed, one of the purposes of fine milling is to reduce the mineral ash of flour. According to analyses of Forbes,[2] the elements are distributed in the wheat berry in something like the following percentages:

[1] See discussion of vitamin D on page 162; D is apparently a regulator of the calcium metabolism.

[2] E. B. Forbes, F. M. Beegle, and J. E. Mensching, "Mineral and Organic Analyses of Foods," *Ohio Agricultural Experiment Station Bulletin 255,* January 1913.

Element	Wheat	Wheat flour	Wheat bran	Wheat shorts	Wheat germ
Potassium	0.520	0.050	1.320	1.021	0.296
Sodium	0.310	0.110	0.201	0.165	0.721
Calcium	0.050	0.019	0.125	0.096	0.071
Magnesium	0.130	0.016	0.531	0.383	0.340
Phosphorus	0.373	0.088	1.110	0.876	1.050

From this it is apparent that both the germ and the coat hold more mineral matter than the endosperm.

How important is this difference in a mixed diet, in the average American diet? Other things being equal, would it be worth while to use whole wheat flour instead of white flour in order to obtain the difference in mineral elements?[1] If one were subsisting largely, or even heavily, on wheat flour —yes; but otherwise—no, not for people whose food consists of wheat to the extent of one-fourth to one-half of the total. If bread were a crucially important source of minerals in relation to the total mineral requirement, and if the minerals of the wheat offal were inherently superior to the minerals of the white flour, then it would be important to use whole wheat flour instead of white flour. But no such situation obtains. It is far better to seek the mineral elements in milk, vegetables, and fruits. The outstanding importance of milk as source of calcium and phosphorus is one deserving of the widest recognition. To secure really needed mineral elements by the use of wheat bran and wheat germ would be a makeshift, contrasted with the advantages to be secured when the mineral elements are obtained in milk and vegetables. In the same sense, it would not be worth while to use molasses or raw sugar instead of refined sugar in order to obtain mineral salts, since these are more readily obtainable in milk and other foodstuffs. The mineral content is one of the numerous factors, the others to be mentioned elsewhere, in the outstanding importance of milk in the human diet.

We conclude, therefore, that in the statistical average American diet the mineral elements in wheat offal are of subordinate practical importance since they constitute in no sense a preferred source of supply. The statistically average intake of milk, fruits, and vegetables makes the mineral elements in wheat offal dispensable. In consequence, in the average diet there is no purpose in consuming any other flour than white flour, so far as the mineral elements are concerned. Under peculiar and isolated circumstances in the diet, associated with a shortage of milk, fruits, and vegetables, the mineral intake may become so reduced as to indicate the use of whole wheat bread instead of white bread. The proper disposition of such an abnormal set of circumstances, however, is not to be content with such a makeshift as wheat offal, but to secure the adequate amounts of milk, fruit, and vegetables in the diet. The mineral elements might be secured by use of appropriate salt mixtures; but this also would be a makeshift. The correct solution is to secure and maintain the adequate use of milk, fruits, and vegetables.

[1] A diet should yield an alkaline ash; acidosis is the term applied to symptoms due to relative shortage of alkali. From the standpoint of acidosis, the white flour would be superior to whole wheat flour, since the ash of the latter, when burned, yields more acid.

Wheat as a Source of Vitamins

For a long time certain diseases have been recognized as peculiarly dependent on the state of nutrition. Such are scurvy, pellagra, beriberi, and rickets. By some regarded as due to poisons and by others regarded as bacterial infections, they are now recognized as due to deficiencies in the diet. Within the function of nutrition are the chemical elements of the body (inorganic and organic) and also regulatory substances by which the utilization of the nutrient materials is directed and controlled. To one large group of regulatory substances that influence various functions of the body, the term hormone has been applied. The members of a special group of regulatory influences related to nutrition are called vitamins.

The subject of vitamins — their nature, origin and distribution, relation to growth and nutrition, and the results that follow their withdrawal from the animal body— lends itself poorly to nontechnical discussion. In the first place, intricate concepts of physiology are involved. Secondly, the factual material consists more of experimental results on animals than of clinical observations on human beings. The at-

tempt is being made, through animal experimentation, to secure information with which deficiency diseases in human beings may be identified and explained. In what follows, only the barest outline can be presented, and this represents in part an interpretation of conflicting views. All that is here attempted is to make clear what is known of deficiency diseases in relation to the vitamins contained in wheat.

We have information tending to indicate the occurrence of five vitamins, arbitrarily called A, B, C, D, and E. Vitamins are as yet best understood by what happens when they are withdrawn. Their mode of action is as yet not open to hypothesis; but the deficiency diseases that follow their withdrawal from the diet are used to identify them. No vitamin has been yet isolated. Vitamin A has a determining influence on growth and tissue resistance. Vitamin B is the vitamin whose absence leads to beriberi. Vitamin C is the vitamin whose absence leads to scurvy. Vitamin D is the vitamin whose absence, it is now inferred, leads to rickets. Vitamin E is the vitamin whose absence leads to sterility. These designations are all too abrupt and inconclusive, but will suffice us here. Future investigations may expand the number of the vitamins and much is still needed in the direction of precision of our information.[1]

Vitamins are widely distributed but vary greatly in the degree of concentration in foodstuffs. The vitamin contents of different foodstuffs are being standardized by feeding experiments on animals. Some vitamins are stable, others highly unstable—factors of great importance experimentally and nutritionally. The vitamins are widely synthesized in plant life; for the most part, animals secure their vitamins from plants in the diet and do not synthesize the vitamins in their own bodies. Many microscopic forms of plant life synthesize vitamins and thus vitamins may be formed by fungi in the intestinal tract of animals, a point of practical importance in herbivora. But it is not proved that animals do not synthesize vitamins in their tissues. For illustration, the liver of the cod is rich in vitamins; is it to be supposed that these were synthesized by marine plants and taken in with the food supply of the fish, and not synthesized in the tissue of the fish? The relation of light to the synthesis of vitamins is now being intensively investigated. Wherever the ultimate source, one by one the vegetables, fruits, cereals, legumes, and edible animal products are being graded on the basis of vitamin content, both as to kinds and amounts of vitamins present.

The approved method of investigation is to use the white rat, whose rate of growth and nutritional requirements have been standardized. A basal diet is prepared, free of vitamins, but containing the necessary salts, protein, fat, and carbohydrate. Through the period of test, the animals are fed with the standardized diet, plus known amounts of the particular food under investigation. It is sometimes practicable to check such tests with the use of standardized concentrated preparations of vitamins. Rapid advances are being made in the production of concentrated preparations containing vitamins, and the day is probably not distant when standardized preparations of active vitamins will be available on the retail market.

So far as wheat is concerned, we are practically concerned only with vitamin B. Wheat ranks relatively low as a carrier of vitamin, excepting B and E, being therefore low in vitamins A, C, and D. Vitamin E is present in the wheat germ in high concentration; indeed, in the oil of the wheat germ is found the highest known concentration of the fecundity vitamin. A dietary deficiency in vitamin as a practical problem, so far as wheat is concerned, involves only vitamin B. The vitamins B and E are mostly in the germ; the bran is not rich in B and it has little E. The endosperm is low in vitamin. Since there is no known disease involving vitamin E,[2] it follows that only

[1] Lay readers desirous of familiarizing themselves with the subject of vitamins will find an excellent presentation in *Your Weight and How to Control It*, edited by Dr. Morris Fishbein and published by the George H. Doran Company in 1927. An exhaustive technical discussion is to be found in *The Newer Knowledge of Nutrition*, by E. V. McCollum and Nina Simmonds, 3d ed., published by the Macmillan Company in 1925. The conflicting interpretations of animal experiments and clinical observations are brought clearly to light in the last named book.

[2] Recent observations lead one to suspect that vitamin E may act as a regulator of the iron metabolism, as vitamin D is believed to act for the calcium metabolism.

under peculiar and exceptional circumstances are the vitamins of wheat of practical importance in the diet.

The classical illustration of a vitamin-deficiency disease is beriberi, a disease long known in the Orient which at times has expanded to the dimensions of a scourge. It is a degenerative disease, of which inflammation of the nerves and spinal cord is the outstanding symptom. As beriberi occurs in the Orient, it is the result of eating a diet consisting predominantly of polished rice. The mere eating of polished rice does not cause the disease; nor are all cases of beriberi provoked by the eating of polished rice. Only when the diet consists largely of polished rice, does beriberi develop. Beriberi may be caused by an exclusive diet of salted fish; it may also be provoked by patent wheat flour or corn flour, when these are the predominating articles of diet.

In the parts of the rice berry removed by polishing is vitamin B, whose withdrawal provokes the disease.[1] The polished rice is not itself injurious; it merely lacks an essential element. The B is present to much larger extent in the germ than in the bran, and a small amount of the rice germ will prevent the disease. When the victims are fed unpolished rice prompt recovery ensues, unless the affliction has been extreme. Also, recovery may be brought about with vitamin B contained in other sources. Finally, beriberi may be prevented without disturbing the use of polished rice by the administration of vitamin contained, for example, in yeast.

The endosperm of any grain may be compared with polished rice as a possible cause of beriberi. We have no records of beriberi produced with the use of white flour. Since the endosperm of wheat and of rice seem equally devoid of vitamin B, there must be some determining reason why polished rice in the Orient has caused beriberi while white wheat flour in Europe and North America has not caused beriberi. The answer lies in the other components of the diet. In the Orient, the foodstuffs in the diet outside of polished rice were deficient in vitamin B; in Europe and in North America, the foodstuffs in the diet outside of the white flour were not deficient in vitamin B, but contained enough to maintain health. If, instead of white wheat flour in the proportions in which it has occurred in the diet in Europe and North America, polished rice had been used in identical amounts, beriberi would not have occurred because of the protective action of the vitamin B in the other foodstuffs.

In every question of deficiency disease due to lack of a vitamin, the outcome is determined not by the absence of the vitamin from a particular foodstuff, but by the absence of that vitamin from the entire diet. If the diet contains enough vitamin B to be adequately protective, it is immaterial whether this is obtained in all of the foodstuffs or in only a few of the foodstuffs. It is when one foodstuff, deficient in vitamin, constitutes practically the entire food supply, or is combined with other foodstuffs deficient in vitamin, that the vitamin-deficiency disease arises. One of the most impressive facts in our knowledge of vitamins is the striking action of a small amount of the vitamin-carrying foodstuff. Vitamin B is widely distributed. All the fruits and vegetables contain it, it is present in milk, eggs, and meat, and is absent or deficient only in the rendered animal fats, the refined vegetable oils, in sugar, and in the finely milled cereals. There has never been a clear-cut beriberi problem in the United States.[2] No one could develop beriberi on the average mixed diet of this country; indeed, the average mixed American diet would act as a rapid cure for beriberi. Doubts concerning the use of white flour in our diet cannot be based on fears of beriberi, as customarily understood.

Pellagra is a complex degenerative disease, associated with pronounced weakness of the muscles, digestive disturbances, skin eruptions, polyneuritis, and often terminating in insanity. It is usually most marked in early summer. Long before it was recognized in the United States, pellagra was common in Europe, particularly in Spain and Italy and in the Danube countries, where it was commonly ascribed to the use of immature or decomposed corn.

[1] Vitamin B seems also to exert a stimulating action on appetite and digestion.

[2] Possibly, before the Civil War beriberi occurred among plantation negroes subsisting largely on polished rice. Rice offal is very rich in vitamin B.

It is now recognized that corn as such has nothing to do with the disease.

Pellagra in the United States is associated with what might be termed a general depravity of the diet, occurring in underpaid and underfed classes living under bad conditions of sanitation; it is more common in the South, though by no means confined to the southern states. Pellagra in institutions, jails and asylums, has sometimes been the result of graft. The pellagra diet consists usually of degerminated corn meal or white flour or both, molasses or syrup, lard and salt pork, salt fish, potatoes, and dry beans. Conspicuous is the absence of or shortage in milk, eggs, and fresh meat, and the diet is low in protein. Such a diet is deficient in all vitamins, but especially in B; it is deficient in balanced protein; and it is deficient in roughage. Persisted in, the disease progresses slowly but progressively, with notable seasonal exacerbations.

Pellagra does not directly respond to treatment with vitamin B, as does beriberi. The patients recover promptly when milk, eggs, and fresh meats are added to the diet; and under these circumstances, preparations containing vitamin B seem to accelerate the recovery. Milk is a specific, especially in early cases.

Neither the experimental nor the clinical investigations are satisfactory. Some clinical investigators regard pellagra as a combination of beriberi and protein starvation; others, as a combination of protein starvation with scurvy. Certain symptoms of the disease strongly resemble war dropsy, regarded as the result of protein starvation. Lastly, other investigators regard pellagra as an independent deficiency disease, of which the specific factor has not yet been determined. Of the importance of shortage of milk, eggs, and fresh meat in the etiology of pellagra, there can be no question. Recently attention has again been directed to vitamin B.

It is to be conceded that if an American is trying to live on wheat and corn flour, baking powder, lard, molasses, sow belly and salt fish, the corn meal should be fresh whole corn meal and the wheat flour should be fresh whole wheat grist flour. Whether this would prevent pellagra and maintain nutrition, in the absence of improvement in the protein ration, remains, however, doubtful. Judged by the clinical results, the restoration of a proper protein intake through the use of milk is far more important than the use of whole grain flour. Obviously pellagra is the result of degraded diet peculiar to isolated circumstances of poverty and ignorance (or criminality), and no lesson to be drawn therefrom ought to be imposed upon the intelligently diversified American diet. The reform of the diet in pellagra does not apply to the average statistical American diet, which is better than the diet used to cure pellagra in institutions. What is required for the elimination of pellagra is elevation of social standards and of the level of earnings, with the education and improvement in the scale of living that go with them.

Rickets has been regarded as a disease associated with vitamin deficiency and shortage of mineral elements and thus possibly dependent on the use of finely milled cereals instead of whole cereals. More recent investigations, however, and especially the studies on the effects of light on rickets, have changed the views of the medical profession. All cereals are low in lime and phosphorus; the milled flours are merely more deficient than the whole grain. In rickets, something prevents the skeletal tissues from building sound bone and depositing the lime salts properly. In the blood serum of rickety children, the lime content is little changed from normal, but the content of inorganic phosphorus is peculiarly low. Cod liver oil contains the factor determining the normal function of the skeletal tissues; when it is administered, the local disease is arrested and the normal relation of calcium and phosphorus in the blood serum is restored. Exposure to sunlight, and also to ultra-violet light, has the same effect. Finally, selected rays of light will "activate," i.e., endow certain otherwise inactive fats with the protective property naturally possessed by cod liver oil —that is, the protective factor can be synthesized in an appropriate foodstuff by exposure to light. Inferentially, the natural occurrence of the anti-rachitic vitamin, as in cod liver oil (and other fats and oils) rests upon activation, or synthesis, by light.

The cereals do not contain the anti-

rachitic factor, and it would be to no purpose to use whole grains, rather than white flours, on that account. Nor is the calcium content of whole grain sufficiently higher than that of flour to warrant the change. The conclusion to be drawn from recent work on rickets is that milk and the green leaf vegetables are the indispensables in the diet of growing children, and beyond this no dietary adaptations are indicated. Incidentally remarked, the old-fashioned doctors, who used to give children a course of codliver oil treatment during the winter, have been convincingly vindicated.

Recent investigations, confirming old but poorly defined medical opinion, indicate in respect to vitamin D that activation by light may be secured in the living body. In other words, rickets may be prevented and cured by sunshine. Also, the vitamin D content of cow's milk is dependent both on the diet and on the exposure of the animal to light. The milk of dairy cows housed in barns during the winter is inferior to the milk of cows kept outdoors during the daytime; in protecting the milch cows from the rigors of winter, they are also protected from the beneficent action of sunshine. It is gradually becoming apparent that the production of milk under high-pressure dairy methods, involving the forced use of concentrates with animals kept in barns, may yield a milk normal in protein, sugar, and fat, but deficient both in vitamins A and D and possibly in minerals also. Since milk is being relied upon to keep the diet competent, the milk must be kept competent by appropriate feeding and care of milch cows.

Apart from pellagra, as stated above, there is nothing to indicate that the current American use of white flour threatens us with any deficiency in vitamin. There are so many other foodstuffs containing vitamins that a shortage seems practically impossible, when the diet contains milk and fresh fruits and vegetables. This is particularly the case when one recalls that wheat flour composes only one-fourth of our diet. If wheat flour were three-fourths of our food supply instead of one-fourth, it would be necessary to use whole wheat flour instead of white flour. But with the diet composed, to the extent of three-fourths of its calories, of diversified foodstuffs, many of which are rich in vitamins, especially milk, the wheat in one-fourth of our diet is not to be regarded as a necessary source of vitamin. If one is after vitamins, whole wheat flour is a poor makeshift.

It may be urged that all individuals, and especially children, do not receive their share of milk and fresh vegetables, and that the deficiency in milk and fresh vegetables might well be made up by the use of whole wheat bread. This would represent an obvious and lamentable makeshift in a country with the diversified agriculture and dietary standard of the United States. The suggestion might have some validity if only vitamin B were involved; but when one considers the other nutritional attributes of milk, the suggestion fails to meet the case. What is wanted is not arrangements for doing without milk, but arrangements for securing milk.

On technical grounds, there is no effective way of retaining the vitamins of the wheat kernel except to include the germ in the flour. With the germ included, the flour is prone to decomposition. The baking quality of flour depends upon proper maturing after grinding. The flour trade and baking industry of the country depend upon flour being so made as to keep sound and sweet, over many months with ordinary precautions. It is technically impossible to provision the country with a flour containing the germ, since it cannot be sterilized, or kept in cold storage to retard decomposition. If it were desirable, on economic or other grounds, to have the vitamins of the germ, specifically vitamin B, retained in the bread, it would be far better to have the baker add it artificially than to have the miller keep it in naturally.[1] In recognition of the unbalanced nature of wheat protein, the addition of milk protein to bread has become practically standardized in the baking formulas in this country. Vitamin B could be similarly added, if regarded as so advantageous as to appear commercially necessary. Animal tests indicate that white milk bread is as competent as whole wheat bread, but more

[1] The now prevalent use of large amounts of yeast substantially increases the content of vitamin B in white bread.

vitamin B could be added if thought advantageous. If bread were a crucially important source of vitamins, and the vitamins of grain offal were crucially superior to the vitamins of white flour, then it would be important to use whole wheat flour instead of white flour, but such is not the case.

To see the effete clubman, seated at a table covered with foods drawn from all regions and loaded down with vitamins, ordering whole wheat bread in order to secure vitamin B, is strikingly illustrative of the carrying power of propaganda.[1]

Wheat as a Source of Roughage

Wheat is a source of roughage in the diet only to the extent to which bran is used in whole wheat flour, whole wheat breakfast cereals, and bran breakfast cereals. Though foodstuffs containing bran are prominent among the advertised foodstuffs, the amount of roughage thus introduced into the average diet is small. For practical purposes, the roughage in the American diet is obtained from fruits and vegetables.[2]

We have, however, a bran cult, proclaiming with insistence for all the use of bran in the diet. To the extent that public agitation on behalf of bran merely represents advertising copy, it may be dismissed. There is no way of knowing whether the bran fad has increased in number of adherents during the past generation, since we possess no trustworthy records of the proportions of wheat flour consumed respectively with and without bran. In publicity the fad has increased, in consequence of the larger public attention now being given to all health aspects of the diet, promoted in addition by interested parties. The advocates of the use of bran in the diet support their arguments in favor of bran as a roughage by invoking also the proteins, the minerals, and the vitamins contained in the covering of the wheat. We have discussed these in other sections, and limit the discussion here to the factor of roughage.

The advocates of bran as roughage assume either that roughage is lacking in the average diet; or that the roughage intake in fruits and vegetables is inadequate and bran should be used in addition thereto; or it is implied that the roughage of fruits and vegetables is inferior and that bran roughage ought to be used in substitution therefor.

The wheat berry may be roughly divided into the endosperm, the germ, and the coat. The endosperm comprises about 82 per cent of the weight of the kernel, the coat around 16 per cent, and the germ only 2 per cent, the proportions varying from variety to variety of wheat and from year to year. The bran is composed largely of fiber, i.e., cellulose.

The roughage requirement of the diet varies from person to person, and is not relatively the same at different ages or in the two sexes. It varies from season to season, also with occupation and physical activity. Discerning physicians have long recognized that the roughage requirement is distinctly an individual variable.

The most effective roughage is to be obtained in raw bran and in raw fruits and vegetables. In cooked or baked bran, fruits, or vegetables, of the same fiber content, the roughage is less effective. The more effective the roughage, the more likely it is to irritate the alimentary tract and provoke digestive disturbance. Among the different kinds of roughage, for most persons bran is likely to be found less acceptable than the fibers of fruits and vegetables; and in particular, among the numerous fruits and vegetables, each individual is likely to find

[1] "The attitude which one should take toward the discussion of the relative merits of bolted as against whole wheat flour is now easy to understand and appreciate. The latter is decidedly more suitably constituted to maintain well-being for a short time if it serves as the sole article of diet, as it might under famine conditions. Whole wheat flour is an incomplete food and must be supplemented with other foods in order to compensate for its deficiencies. The unfortunate individual, who through faulty habits of living finds at an age at which he should be still in possession of the full vigor of middle life that his efficiency is diminishing and the joy of living slipping away, has not infrequently turned for relief to substituting whole wheat flour for the staple white variety. As a rule those who advocate this practice exhibit in some degree the spectral mien of the dyspeptic. They would gain much more through adhering to a diet well balanced than through adopting this or any other dietary whim or fad." E. V. McCollum and Nina Simmonds, *The Newer Knowledge of Nutrition*, 3d ed. (New York, 1925), p. 132.

[2] It is erroneously assumed that the laxative action of bran and of fruits and vegetables is due solely to roughage. But in fact phytin aids in the action in the case of bran, while in the case of fruits and vegetables, organic acids and fermentative products contribute to the effect.

that certain of them prove best adapted to his alimentary tract.

There are many degrees of the bran cult, some of which border on mysticism. Some extreme advocates of whole wheat wish to use no flour, but only coarse grits instead; some insist that the wheat kernels shall not be rolled but only cracked; still others insist that the wheat kernels must be cut. If bran is desired as roughage in a mixed diet, it would seem preferable to use blended flours, made by sifting bran back into white flour. Such a blended flour keeps well, in contrast with whole wheat flour. In such a flour it is possible, with special milling or with the use of sieves of different mesh, to have the bran particles finer or coarser, as desired. Also, the proportion of bran may be modified at will—for example, all the way from 10 to 50 per cent. If bran is to be rationally employed in bread as roughage, this is the best way of using it. If bread were a crucially important source of roughage and the roughage of grain offal were crucially superior to the roughage of other foods, then it would be important to use whole wheat flour instead of white flour. But such is not the case. In special cases where bran acts well, it is best used as breakfast cereal and this use is growing.

The advocates of so-called health breads fall into five groups. First we have the teachers of home economics and nutritional experts engaged in education, both of whom naturally tend to exaggerate their specialty. Secondly, we have food faddists, who are prone to support new projects, or take extreme positions on old topics, in order to appear advanced and esoteric. Thirdly, we have food cranks, often dyspeptic and neurasthenic, who magnify their personal idiosyncrasies to racial proportions. Fourthly, we have the quacks—medical, semi-medical, pseudo-medical, and anti-medical—who extol health breads for fees. Lastly, we have the writers of advertising copy being put out by acquisitive manufacturers of whole grain products. Of the followers, some use whole wheat bread because they like it, but more use it because they have read or heard that it is good for this, for that, or for the other ailment.

The tone of advertising copy and the extreme claims of purveyors of special foodstuffs are certain to be moderated in consequence of mergers of food manufacturing establishments. When a concern sells, side by side, a coffee substitute, a decaffeinized coffee, and a national brand of natural coffee, the advertising of the coffee substitute is certain to be less extreme than in the case of a manufacturer whose sole business is making coffee substitute. When a bran breakfast cereal, a whole wheat breakfast cereal, and a refined white wheaten breakfast cereal are marketed side by side by the same concern, the advertising of bran is certain to be more restrained than in the case of a manufacturer whose sole product is bran breakfast food. Special factories devoted to one wheaten product are tending to disappear, being taken over by manufacturers who market many products. Thus, the commercial incentive of unbridled advertising will decline; gradually the propaganda in favor of bran will be confined to the faddists and will not become supported by the manufacturers. With the faddist will remain the medical quack. It is fair to conclude that the deceptive propaganda on white bread versus whole wheat bread, when confined to quack physicians and food faddists, will decline to small dimensions.

Nothing in the above reflections applies to those who use whole wheat bread because they like it. What is objected to is that advocates of bran try to impose their hobby on society as physiological doctrine applicable to all. As a matter of personal taste, the bran diet is unobjectionable; as a nutritional system for all persons, it is devoid of foundation.

To the vast majority of Americans it is not a matter of indifference, nutritionally or esthetically, whether their table has whole wheat bread or white bread. The appearance of white bread is more attractive, the texture is finer, it toasts better. Whole wheat bread has a pronounced taste of its own; white bread has a bland wheaten taste that lends itself well to spreading materials. That whole wheat bread has made so little progress since the day of Graham, is due to the weak appeal it makes to the taste. Certainly the place of wheaten bread in the diet will not be enlarged by insistence on the use of whole wheat bread.

IV. GENERAL OBSERVATIONS ON NUTRITIONAL COMPETENCY OF FOODSTUFFS

No foodstuff should be appraised by itself, apart from the other foodstuffs. Not what a food is good for alone, but how good it is in combination with other foodstuffs, is the measure to be applied. Otherwise an article like lard or sugar would find no place in the diet. And the best single food, milk, lacks qualities that in the long run are found to be essential in the diet. Such a correlated appraisal should be both qualitative and quantitative, and done with sound physiological perspective.

Practically all foods are deficient in one direction or another; no single foodstuff can be depended upon indefinitely to sustain nutrition in a normal manner. In addition, certain foodstuffs as they appear in trade have by processing been made more deficient than they were naturally. The conspicuous illustrations are refined sugar, polished rice, white flour, corn flour and hominy, rendered animal fats, refined vegetable oils, and starches, including products like sago and tapioca. For natural reasons, the customary cuts of meat (muscle meats) are relatively deficient in dietary factors, being far inferior to the visceral organs; as a class they stand somewhat above the cereals. Provisioning a people, or rationing a group, involves combining in appropriate proportions, to make a balanced whole, the relatively competent foods with the relatively deficient foods.

It is possible, but not desirable, to incorporate all the elements of nutrition into a single food. With development of chemical and manufacturing technique, it is now possible to prepare the perfect biscuit for man, just as it has been possible to prepare the standard diet for the white rat. Several years ago, a large baking company put out a mixed bread that contained (or was supposed to contain) all the elements essential for satisfactory nutrition, a single food capable of sustaining growth and health. This perfect bread proved a commercial failure. Such a food is of interest to explorers, surveyors, and prospectors; but it holds no appeal to people who wish, quite naturally, to please their tastes with diverse foods in varying combinations of preparation and service. Man does not choose to live by bread alone—or by any other single article of diet, no matter how competent. Such rationalization may be applied to industry, but not to nutrition. A diet has esthetic and psychological values, as well as physiological values.

It is neither necessary nor desirable to have the foods so combined as to make every meal nutritionally complete; it is enough to have the food of the day competent. Indeed, in view of the storage of vitamins in the tissues, it seems that it might be sufficient to have the food of the week competent.[1] But though this might hold for balanced protein and vitamins, it would not hold for roughage or energy foods, which ought to be held close to an average intake. Beyond this, the concept of balance and competency tends to be exaggerated. Nutritional doctrines must be kept in harmony with economic considerations. The art and science, and also the social economy, of the diet lie in combinations: "The keynote to the discussion of the individual foods entering into the diet of man is the importance of using proper combinations of foods."[2]

Looking back over the past half-century, we observe a decline in the per capita intake of all food, decline in per capita intake of cereals,[3] and increase in per capita intake of sugar. Corn has suffered greater decline than wheat, both relatively and absolutely. With appropriate qualification and adjustments for other foodstuffs, it may fairly be stated that the decline in use of cereals has been effectuated mostly by substitution with sugar. Sugar contains no protein, vitamin, or mineral elements; it is strictly an energy food, which owes its popularity largely to its taste and to the flavors developed when it is added to other foodstuffs. The expansion in the use of sugar has been in part associated with expansion

[1] It would not be sufficient to have the ash of the diet alkaline for the week; this ought to be secured for the day.

[2] E. V. McCollum and Nina Simmonds, *The Newer Knowledge of Nutrition*, 3rd ed. (New York, 1925), p. 132.

[3] See WHEAT STUDIES, July 1926, II, No. 8, and December 1927, IV, No. 2.

of the use of fruits and vegetables. The protein, vitamins, and minerals in the cereals displaced by sugar have been in part replaced by protein, vitamins, and minerals in fruits and vegetables. The net effect is not measurable, but there can be little doubt that the level of competency in intake of protein, vitamins, and minerals has improved during the past fifty years.

Modern flour milling, like sugar refining and the refining of fats and oils, is based upon mass production, uniformity of product, cheap distribution, and low price to consumers. The savings thus made available to society are to be secured only if these foodstuffs are employed in proper combinations with other foodstuffs that are complementary to them. The problem is to secure the adequate and competent national diet at the lowest cost, and the true solution is to be sought only by proper combination of highly manufactured foodstuffs with other foodstuffs in their natural states. The heart of this problem lies in the milk supply of the country—and it is not extraneous to the subject under consideration to urge that the milch cow is in the van of the agricultural progress of the country. So long as the consumption of wheat in this country stands at the present level, or anything approaching it, the outstanding objective in the use of wheat is to secure heat units. Wheat is primarily a fuel food. A distinctly secondary purpose is to secure protein. The mineral salts and vitamins of wheat scarcely enter the picture of the national diet; certainly they need not enter unless milk, fruits, and vegetables are deficient. The roughage of wheat is needed only by those who prefer wheat roughage to that of fruits and vegetables. The use of wheat for any other purpose than to secure starch and protein is uneconomical, in view of the advantages that would accrue from the use of other foodstuffs to supply vitamins, minerals, and roughage.

The Appeal for Increased Consumption

Are there nutritional reasons for appealing for a larger consumption of wheat? Do we stand too low in the wide range of wheat consumption, compared with other countries—not for reasons of price and convenience, but for reasons of physiology? The answer is in the negative.

There are no nutritional reasons for urging an increased consumption of wheat and a lessened consumption of other cereals, or an increased consumption of wheat and a lessened consumption of meats and vegetables. In the declining trend of consumption of cereals over recent decades, corn has lost most, and apparently all the cereals combined have lost more than wheat. This is exactly what would be expected with the gradual transfer of baking from the home to commercial bakeries. But there is no nutritional ground for urging the further substitution of wheat for the other cereals. Our use of meat is probably declining and that of vegetables is certainly increasing. There is no nutritional reason for checking the growing use of vegetables or accelerating the declining use of meat in favor of wheat.

We conclude, therefore, that there is no physiological reason why the customary intake of wheat in this country, howsoever ingested, should be regarded as too low. There is no reason why it might not be somewhat lower; indeed, millions of Americans consume less wheat than the average of wheat in calories, as computed by Pearl. On the other hand, there is no nutritional reason why the consumption of wheat should not be substantially increased, no nutritional reason why the use of white flour should not be substantially increased. But the reasons must be those of taste, convenience, and price, not of physiology.

What might be termed the customary range of use of cereals in the diet would be from 30 to 60 per cent of the total calories. Whether a particular diet with a cereal proportion at any point within this range is competent or incompetent, advantageous or disadvantageous, would depend less on the cereal fraction itself than upon the other components of the diet. The lower the proportion of cereal in the diet, the easier to include the various indispensable elements. When diets contain cereals in ascending proportions, beyond 50 per cent of the total calories, it becomes increasingly difficult to secure the indispensable elements in adequate amounts.

The American diet may be termed lux-

urious in that meats are used for fuel instead of cereal; or, to be more specific, protein is used for fuel where carbohydrate would serve as well. On account of the fact that proteins are burned in the body with an acid ash and the end-products entail a renal elimination, while starch is burned in the body without ash and with no end-products to entail any such elimination, it has been widely urged that the use of protein should be limited to the protein need of the tissues and not employed as a fuel. From this point of view, it would be advantageous to have a larger use of cereals, provided this implied a lower intake of protein. Whether this implication holds, is, however, not so easy to determine, since the caloric content of meats is largely due to fat, while the cereals themselves are relatively heavy in protein.

Since fats may leave an acid residue when burned in the body, while starches do not (except in the sense that carbonic acid is an acid), it has been urged, other things being equal, that it would be better to use cereals freely and fats sparingly as fuel instead of fats freely and cereals sparingly. Thus, it would follow, since the American diet is heavy in fat and light in cereals, that increase in intake of cereals and decrease in intake of fat might be advantageous. The physiological reasoning may be sound, but it is not clear how important it is in practice.

Possibly, perhaps probably, the consumption of wheat in the United States has declined to a position of stable equilibrium. Milling journals seem to hold the view that the bottom has been reached and an upturn is in prospect. We do not believe consumption will be increased in response to appeals by producers. We do not anticipate that such fluctuations in wheat prices as are likely to occur would make any sensible difference in consumption. If the prices of meats and sugar, of fruits and vegetables, were to rise substantially, this would influence people to consume more wheat. If the prices of meats and sugar, fruits and vegetables, should decline substantially, which is improbable, the effect might fall more on other cereals than on wheat. Should the prices of foodstuffs, the outlay, and the proportion of the income expended for foodstuffs become matters of substantially larger concern than they are today, the net result, we feel, would be a noteworthy increase in the consumption of wheat; otherwise, there is little incentive to change the current practice.

V. THE ECONOMIC BEARINGS OF WHEAT CONSUMPTION

Wheat Consumption in Relation to Price

The price of foodstuffs is important in this country, despite the small proportion of the average American income that is expended for them. Whenever a foodstuff is universally liked, covers nutritional needs appropriately, meets with established taste and custom, is convenient in use and service and not exposed to conspicuous waste, that food enjoys substantial additional esteem when the price is low. This is the position of wheat flour and of bakers' bread. Yet despite relatively low price, the consumption of wheat has slowly declined over several decades. The per capita decline has been due in part to per capita decline in total food intake in terms of calories: in part it has been due to substitution. To some extent, wheat has replaced corn and the other cereals; but to a greater extent, wheat has been replaced by sugar, and to some extent by fruits and vegetables.

Demand for wheat is relatively inelastic. Bread is often used as illustration of inelasticity of demand. But the reaction of the consuming public varies widely from country to country, and from class to class. If demand for wheat is relatively inelastic in the United States, then in Europe it would be comparably more elastic and elsewhere still more elastic. But general statements mean little and statistical studies of the demand for wheat in relation to price are singularly lacking.

Individual reactions vary widely. If two persons of whose diets bread constitutes a fourth were suddenly confronted with extraordinary increase in the price of bread, the one might respond that since bread is so small a part of his diet he would not give it up but would pay the price, the other

might respond that since bread is so small a part of his diet he would not pay the price but would drop it entirely. Much depends upon purchasing power, upon proportion of the income spent for food, and upon custom and convenience. In every community are persons for whom price will modify the effective demand for wheat, and others who will show no such reaction. The behavior of a population as a whole would represent an averaging of plus and minus adjustments. Probably a discerning student of home economics could better judge the outcome in a particular case than an authority on theoretical economics. Side by side, one finds it preached that hard times in this country increase the consumption of wheat and that hard times reduce the consumption of wheat; the first is undoubtedly the more correct teaching, but the latter persists. When wheat stands low in a diet, hard times will tend to enlarge the use of it; when wheat stands high in a diet, hard times will tend to lower the use of it.

In dealing with this subject since the war one must use retail, not wholesale, prices. This makes the question much more difficult, because comprehensive retail prices are difficult to assemble, they lag behind wholesale prices, and to a considerable extent wholesale prices fail to register on the retail market at all. But only from retail prices may trustworthy inferences be drawn.

The cheapest foodstuffs (not including vegetable oils in this discussion) are wheat flour, rye flour, corn meal, rolled oats, rice, and sugar. These are all highly concentrated starchy foods and relatively nonperishable. In order to secure an idea of the price of these staples, we may use averages of the retail prices reported for fifty-one cities in the United States.

Table 2 contains for the past five years, as reported by the Bureau of Labor Statistics of the United States Department of Labor, the average retail prices of cereal preparations and sugar.

Rye flour is not reported. We know, however, that rye flour is somewhat cheaper than wheat, near the rye-growing areas if not in distant regions. Very little rye flour is sold as such at retail; possibly the price for rye flour where sold at retail would be in the neighborhood of that of corn meal. Whole wheat flour (not reported) costs more than comparable white flour, because the losses due to spoilage and to weevils must be paid for, the volume of sales is small, and demand is inconstant.

TABLE 2.—AVERAGE RETAIL PRICES OF VARIOUS ARTICLES OF FOOD, 1924–28*

(*Cents per pound*)

Year	Wheat flour	Bread	Wheat cereal	Corn meal	Corn flakes	Rolled oats	Rice	Sugar
1924....	4.9	8.8	13.9	4.7	20.0	8.9	10.1	9.2
1925....	6.1	9.4	14.2	5.4	22.0	9.2	11.1	7.2
1926....	6.0	9.4	14.5	5.1	21.8	9.1	11.6	6.9
1927....	5.5	9.3	14.6	5.2	20.2	9.0	10.7	7.3
1928[a]...	5.4	9.2	14.6	5.3	19.1	8.9	10.0	7.1
Average 1924–28.	5.6	9.2	14.4	5.1	20.6	9.0	10.7	7.5

* Data from *Retail Prices 1890 to 1926* (U.S. Bureau of Labor Statistics Bulletin No. 445), August 1927, pp. 48–49 and 56–57; also from *Monthly Labor Review.*

[a] Ten months' average; data for November and December 1928 not yet available.

That corn meal is so little cheaper at retail than wheat flour is at first glance surprising. This is due to the fact that the milling of corn is more regional and less widespread than the grinding of wheat; therefore, in many cities relatively high freight charges are incorporated into the retail price of corn meal. Also, corn meal is more prone to decomposition than wheat flour, which has the effect of enlarging the waste and increasing the price. Rolled oats and rice are also manufactured regionally, rather than generally, and the retail prices over the country are heightened by transportation charges. The net result of the above price comparisons is to emphasize the relatively low price of wheat flour per pound. Table 2 illustrates, incidentally, how much more expensive is wheat cereal than wheat flour and corn flakes than corn meal.

But one may go further and adjust the prices to the calorie basis. On the basis of the average prices given above, the number of calories purchasable for one dollar was about as follows:

Corn meal (1,625 calories per lb.).....31,900
Wheat flour (1,640 calories per lb.).....29,300
Sugar (1,790 calories per lb.).....23,800
Rolled oats (1,795 calories per lb.).....19,900
Rice (1,610 calories per lb.).....15,100

These figures indicate how much cheaper is wheat flour than rolled oats and rice and how little cheaper is corn meal than wheat flour. When one considers the characteristics of the two preparations—the limited uses of corn meal and the tendency to decomposition, the large number of uses of wheat flour, the characteristics of its gluten, and the keeping qualities—wheat flour is the cheapest of the group. The first cost of wheat flour is slightly higher than the first cost of corn meal, but the net cost is probably as low and possibly lower.

It is interesting to ponder on the annual monetary outlay for wheaten products. If the nine-tenths of a barrel of flour used by each American per annum had been purchased as flour at the average retail price of the past five years, the annual flour bill would have been $9.88, or 19 cents per week, per person. If the same flour had been purchased in the form of bread (176 pounds of flour equals 240 pounds of bread) at the average retail bread price of the past five years, the annual bread bill would have been around $22.08, or 42.5 cents per week, per person. Large proportions of the purchases are in the form of flour and bread, but considerable wheat is purchased in the form of cakes and pastries, which are more expensive than bread. Perhaps it may be assumed that the higher prices of sweet baked goods balance the lower price of flour and that the price of bread gives a fair figure for the average cost of wheaten products. However viewed, the low sum represented in the money spent for wheaten foodstuffs is striking enough, particularly in view of the fact that around one-fourth of the calories of the diet are thus obtained. Since the sum spent for breadstuffs is so small, there is little incentive in making a saving by lowering it still further; also little is lost if it rises somewhat. In addition, any foodstuff priced in pennies tends to receive secondary attention from even the saving housewife. This all tends to make demand for wheaten products inelastic.

The wheat flour of course is raw and as such is inedible, whereas the sugar is ready to eat. But, in fact, only a small part of the sugar consumed is utilized without putting it through one or another form of cooking in conjunction with other foodstuffs. With full allowance for the facts that sugar is ready to eat, is practically nonperishable, and contains no water, it is certain that the net cost is not so low as the net cost of wheaten flour.

Since the war, several special developments have tended to influence the use of wheat. The first is the industrialization of the South. This has been accompanied by increase in the consumption of wheat and decrease in the use of corn. A second factor has been the disappearance of the western frontier, which has been accompanied by a reduction in the consumption of wheat and beans and an increase in use of other foodstuffs. A third factor has been restriction of immigration. The immigrants are our heaviest bread eaters, especially the Slavs and Italians. Assimilation of the immigrant carries with it the gradual assumption of the American diet; the children of the immigrants adopt the eating habits of the children of the native stock. Lastly, the widespread increase in consumption of cakes and pastries of all kinds has involved a reduction in the use of wheat. Superficially considered, it is often assumed that the contrary is the effect, since persons often eat pastry who would refuse bread. But broadly considered, it is not to be doubted that the addition of 20 pounds to the annual per capita sugar intake has been accompanied by a substantial, if not by a corresponding, reduction in the use of flour. To these special factors must be added the more general influences—a decline in per capita food requirements, the reduction of the average body weight, the change in the age distribution of the population due to increased longevity, and the expanding use of fruits and vegetables.

Despite low price, the consumption of wheat remains low. Whether it would remain low in hard times is not known from comparable experience. Much would depend on how hard the times. Presumably, in some regions and with some classes, corn meal would replace wheat; in other regions and with other classes, wheat would replace meat and vegetables. What the net result would be, only the countrywide test would tell; but if the writer judges American consumers correctly, the net result would be in favor of wheat. Apparently, it

is to no purpose to appeal, on behalf of the producing class, for increased consumption of wheat on the basis of the low price of wheaten foodstuffs. For the time being, consumers make their decisions on other grounds.

Bread suffers at the hands of consumers, not from aversion or opposition, but from indifference and neglect. There are too many available foodstuffs, too many attractive dishes on the table. Bread is always on the table and is an old story to the eye and to the taste. Bread must be chosen or not chosen each meal in competition with dishes that are more or less different at each meal. In short, at each meal bread, the stand-by, has to compete with novelties for the attention of the consumer. With a large proportion of the population trying to reduce rather than increase their diet and their body weight, bread has come to occupy almost the position of a nominal filler. Today there is no one staff of life. Bread remains a highly important foodstuff, common to a great variety of diets, but its basic importance has greatly diminished.

Influence of Use of Whole Wheat on Animal Husbandry

Wheat offal is a specialized concentrated feeding stuff, one of the best from any standpoint and in certain ways the very best. It is largely employed in the ration of the breeding stock during gestation and lactation, also in the growth ration during the suckling period and for a time after weaning. It is most prominent as a dairy feed, and its value to animal husbandry may be fairly judged in terms of equivalents of milk.

Used as a supplementary protein ration in the dairy, the protein of wheat offal is to a large extent recovered in the protein of the milk. The milch cow has a protein metabolism for maintenance and tissue growth; she has a special protein metabolism devoted to the milk secretion. After the other requirements of the body of the milch cow have been fully covered, when the added feeding stuffs designed for milk production are appropriately proportioned, the energy is largely recovered in the milk.[1]

In part, wheat offal is used as food for growth and maintenance, in part as a purely supplementary protein ration for milk production. Just what is the milk equivalent of the wheat offal, applied to the country as a whole, would depend upon many factors. It is probably a safe illustration to use the figure of 38 per cent derived by Forbes,[2] i.e., 38 per cent of the protein of wheat offal is converted into the protein of milk of the usual composition. This may be too high or too low; but as illustration of the importance of wheaten mill feed in milk production, it may fairly be trusted.

Let us assume that we grind 520 million bushels of clean wheat for domestic consumption of flour. This would yield about 4.6 million tons of offal, containing around 650 thousand short tons of protein. Using the factor of conversion mentioned, this would be equivalent to about 15 billion pounds of milk, which is approximately one-eighth of the milk supply of the country, and perhaps one-sixth of the milk supply used as human foodstuff.

From this rough computation, the enormous importance of wheat offal to animal husbandry is apparent. Wheat is not merely our most important cereal food; also it yields one of our most important cereal feeds. To transfer the population of the United States over to whole wheat bread would provoke a revolution in agriculture. With this, however, we need not concern ourselves, because it will never happen.

Another phase of the situation merits attention. The 520 million bushels of wheat now ground for domestic consumption of flour are grown on something like 36 million acres of wheat land. With the country transferred to whole wheat bread, with the same intake as at present, this would involve setting free 10 million acres of land now devoted to the raising of wheat for domestic consumption. The 10 million acres would of course have to be used for the raising of feeding stuffs to replace the mill feed; but this, for much of the wheat land of the United States, would not be a com-

[1] E. B. Forbes, J. August Fries, Winifred W. Braman, and Max Kriss, "The Relative Utilization of Feed Energy for Maintenance, Body Increase, and Milk Production of Cattle," *Journal of Agricultural Research*, September 1926, XXXIII, 483.

[2] E. B. Forbes and R. W. Swift, "The Efficiency of Utilization of Protein in Milk Production, as Indicated by Nitrogen Balance Experiments," *Journal of Dairy Science*, January 1925, VIII.

mercially profitable alternative employment. In short, if the country consumed whole wheat bread instead of white bread, this would reduce the acreage planted to high-priced wheat and increase the acreage planted to low-priced coarse grains, to the commercial loss of the producing class.

In conclusion, it is pertinent to revert to the biological importance of milk in the human diet. The researches of recent decades have made evident the fact that milk is the heart of the American diet. The balanced protein of meat and eggs is important; the vitamins of the green leaves and the fruit juices are very important; the mineral constituents of fruits and vegetables are important. But milk combines so many of the indispensable constituents of the diet, especially for the young, that it is veritably the keystone of the arch of nutrition. It would be technically possible for the country to maintain the milk supply without grain offal, using grains and other concentrates instead; but it would be technically more difficult and certainly more expensive.

In the broad sense, the decision between whole wheat bread and white bread is a choice between bran and milk, representing the alternative uses of wheat offal as feeding stuff or foodstuff. The bran has no unique qualities in the human diet, and for the homely virtues it possess there are many substitutes available. Milk has unique properties and there is no substitute. It may be urged that some peoples live practically without milk, as in India and China. But that rejoinder yields the point at issue, because we are not trying to imitate the diets of India and China.

In countries with a low protein intake, the superiority of wheat protein—especially over corn and millet—is nutritionally important and speaks there in favor of an enlarged consumption of wheat. In countries like India and China, where dairying is but slightly developed, wheat should be consumed as whole wheat flour, to secure the full benefit of the protein. Indeed, in India and China cereals as a class ought to be consumed whole and not milled fine, because grain offal is not converted into an equivalent of higher-value foodstuffs. The very reasons that speak against consumption of wheat offal in the United States speak in favor of it in India and China; or, better put, the reasons that speak for consumption of grain offal as foodstuff in India and China do not apply in the United States.

National Economy of Whole Grain Consumption

It is sometimes urged that cereal consumption in the form of whole-grain meals, instead of in the state of extracted flours, is quite generally in the interest of the national economy. In view of the emphasis laid upon economy in calories during the war and the ease with which war experiences are misinterpreted and misapplied in peace times, the topic merits examination.

Experiences the world over illustrate three sets of circumstances under which enforced national saving of calories imposes on the human population the necessity of consuming cereals as animals do. Under necessity, we include economic compulsion or advantage as well as sheer physical need.

A state at war is frequently under the necessity of compelling the population to subsist as much as possible on domestic production. This usually involves a shift toward vegetarianism, and the transition from the accustomed diet may be both sudden and extreme. Under stress of war, little attention is paid to nutritional considerations. Great Britain and Germany, at the opening of the Great War, were heavy net importers of animal products; they imported animal products in large amounts and also imported feeding stuffs out of which further volumes of animal products were secured. The blockade prevented both animal products and the feeding stuffs from entering Germany; that country was thus compelled to make compensatory adaptations in agriculture and dietary, including the compulsory use of long-extraction flour and whole-grain meal instead of bolted flour. Submarine warfare and shortage of ocean tonnage enforced the same measures in Great Britain. The exigencies of war and consequent adaptations in all the belligerent states of Europe held also for the neutral states to a considerable extent. Even in the United States, straight

flour was substituted for patent flour in order to conserve wheat for shipment overseas. The circumstances will vary from case to case; but in the state at war, the human population will usually be compelled to adopt a coarser diet, tending more toward vegetarianism, in order to save calories and increase production of food calories per unit of area. Indeed, the exigency may be so extreme as to compel the slaughtering of domesticated animals and the use of fodder stuffs as foodstuffs for the human population. In Europe during the recent war, the offal of the bread grains, the coarse grains, and fodder roots were used as foodstuffs to an extent never before known. Use as food was even made of grass meal, prepared by grinding hay stuffs; there is in fact no nutritional reason (apart from the content of fibre) why alfalfa meal should not be as good a foodstuff as mill feed. In short, under stress of war, fine flours are abolished; bread grains are consumed as whole-grain meals, more or less coarsely ground. But the population in Europe paid a heavy price when bran was consumed as food instead of the milk that could have been secured from it, since deficiency diseases developed to a widespread extent. Since the war few in Europe have been in any doubt as to which is the better —a unit of bran or its equivalent of milk.

In a country where population presses continuously and sensibly on the food supply, it may be necessary in the saving of calories to consume whole grains instead of flour. China furnishes a good illustration. The offals of wheat and rice fed to animals are worth less when returned in the form of animal products than when consumed directly, on account of loss of of calories. In addition, the cereal offals represent there an important source of vitamin B; vitamin A must be secured largely from green leaves, and protein largely from legumes.[1] Under extreme pressure of population on food supply, the calories assume greater importance even than the so-called indispensable factors of nutrition—the vitamins, mineral salts, and balanced protein.[2]

The death-rate in such a country is already so high that malnutrition merely makes a bad situation somewhat worse. In a country where porter labor largely replaces beasts of burden, the calories in grain offal cannot be dispensed with. There is of course widespread use of flour and polished rice in China; but if the country were rationed on a strictly animalistic basis, it would be found preferable to have the cereals milled whole.

Thirdly, a country without continuous and sensible pressure on food supplies, but still a heavy net importer, might perhaps find it economically advantageous to consume cereals in the form of whole-grain meal rather than in the form of bolted flour. The decision would depend upon the agriculture of the country and upon the cost of producing the exports required to pay for the imports of cereals. Consider Great Britain. The wheat imports of the country are about 225 million bushels annually. These could be reduced by a fourth if graham bread were to supplant white bread and brown flour to replace white flour. Would this be in the interest of their national economy? Up to the present, certainly not. Great Britain is largely a region of grass. Only in certain areas do bread grains thrive and even here yields are conditioned on the use of chemical fertilizers. Beyond a certain minimum, domestic production of cereals encounters increase in cost; but the grass lands are unusually productive on account of the climate, and under these circumstances mill feed and other concentrates find favorable utilization by pastured animals. From the standpoint of agriculture, diversification based on the use of grain offal, oil seed meal, and coarse grains represents the best utilization of the grass lands.

The industrial productivity of Great Britain is such as to enable the population to choose between consuming mill feed in bread or converting it into dairy products

[1] The soy bean, whose protein is of excellent quality, is the outstanding source of protein in Japan and China. This utility of the soy bean is enhanced by the high oil content and its peculiar adaptability to culinary manipulations.

[2] J. B. S. Haldane has remarked that "about half the human race at the present moment is suffering from partial starvation, and the first requisite for them is to eat more of the cheapest food they can get, vitamins or no vitamins." *Possible Worlds and Other Papers* (New York and London, 1928), p. 59. This comment is probably overdrawn for the world as a whole; certainly it is devoid of application to the United States.

and meats. A highly industrialized nation is not driven towards vegetarianism. It employs its efficiency in manufacture and commerce, in order to secure a more diversified diet with a larger proportion of animal products. If Great Britain were to lose her export markets and if the invisible items in her international trade did not suffice to balance the excess of imports of goods over exports, she might feel herself compelled to go from white bread to graham bread and in other ways to approximate the wartime diet. But so long as Great Britain expands annually her new investments abroad, it is not to be urged that the country stands under the economic necessity of using grain offal as foodstuff. Doubtless the physiologists, on the basis of experiments on the standardized diet of the white rat, would be able to devise for the people of Great Britain a competent diet that would cost the country less than the present diet. Such a human diet, standardized on the white rat, and reinforced by experiences with domesticated animals, would contain graham bread instead of white bread; but it would subordinate appetite to hunger and disregard the psychological factors of nutrition. Important as saving is to an individual and to a nation, there is a point beyond which it is not worth while. And until a country faces such a pressure of population on food supply as to enforce a low standard of living, the impulse to save is not strong enough to make an unsatisfactory diet acceptable for that reason. In effect, an industrialized people employs its talent in part for the very purpose of securing the purchasing power to pay for a better diet. When a country is rich enough and earns enough to choose between foodstuffs, it is idle to suggest how much might be saved if it continued to use the diet of a poor people not in position to choose between foodstuffs. If one shows how much the British might save by using graham bread instead of white bread, one should also show how much might be saved by using cotton instead of wool, and jute instead of cotton.

Arguments advancing the use of whole wheat flour would imply for Europe the reduction of herds of domesticated animals. When Europe imports wheat and mills it into white flour, in effect she imports bread and milk and meat. The use of whole wheat bread tends toward vegetarianism. Europe, with the use of her manufacturing facilities, is headed in the opposite direction.

For the country that is a net exporter of cereals the problem is not how to use less, but how to dispose of more. If the people of the United States were to use graham bread instead of white bread and wheat meal instead of wheat flour, this would diminish the home market for wheat by something like 150 million bushels. Unless eliminated by adjustment in acreage, the wheat thus saved would need to find an export outlet or be degraded to a feeding stuff at home. It is not obvious that it would be in the interests of the national economy to feed 150 million bushels of wheat to animals at home instead of feeding to animals the wheat offal corresponding to that amount of wheat. Indeed, it is probable that the animal products to be secured from wheat offal equal in calories to 150 million bushels of wheat would exceed those to be secured from the wheat directly. The export problem of the wheat grower would certainly not be lightened by increasing the exportable surplus.

VI. CONCLUSION

Biologically considered, the place of cereals in the diet depends largely on the pressure of population on food supply. A heavy intake of cereals is the most effective expression of vegetarianism; and thus, in congested countries, like China and India, cereals occupy by far the most prominent position in the food supply. Broadly speaking, the lower the income of a nation, group, or family, the higher is the proportion of cereals in the diet.

The place of wheat among cereals must ultimately rest to some extent on comparative prices. Apparently, the per capita use of wheat in the world is increasing; but for the time being this is probably the expression of greater freedom of choice rather than the result of lower price.

The place of wheat in the American diet rests for the present on a different basis. In this country there is no pressure of population on food supply; and in the national sense the choice between foodstuffs is not determined by prices, though it is somewhat influenced by them.

The use of wheat in the American diet has declined during the past half century and now stands close to nine-tenths of a barrel of flour per person per year. Whether wheat has reached a stable position in our diet is not established; but impending changes can hardly be of significant proportions.

Wheat now contributes about one-fourth of the calories of the American diet and is therefore still the outstanding single staple foodstuff. The meaning of wheat for us lies primarily in the starch content. It is the starch, which comprises about 70 per cent of the weight of wheat flour, which is the major source of the energy on combustion of wheat flour in the body.

Wheat contributes around one-fourth of the protein of the national diet; in consideration of the quality of wheat protein contrasted with the quality of the protein in the animal products in the diet, the wheat protein is distinctly of subordinate importance. Only for vegetarians and for persons subsisting on a sub-standard level of protein intake, is wheat a significantly important source of protein.

Of the five known vitamins, only one is of possible importance in relation to wheat —namely, vitamin B. It is largely localized in the germ. This vitamin is present in so many other foodstuffs in the diversified American diet as to make the use of the wheat germ dispensable to the average individual. Only where peculiar and, indeed, relatively abnormal conditions obtain, is vitamin B of the wheat germ essential.

Like cereals in general, wheat is not especially rich in mineral elements. These are present in such amounts in milk, fruits, and vegetables as to make the mineral elements of wheat dispensable except under exceptional circumstances of deprivation.

Wheat bran is one of the several available forms of roughage, but in no way a necessary or even a relatively advantageous component of the average diet. For most individuals, the roughage in fruits and vegetables is superior to that of bran. In addition, fruits and vegetables contribute at the same time a more competent supply and assortment of mineral elements and of vitamins than are available in bran.

Nutritionally considered, the place of wheat in the diet may be anywhere up to, let us say, two-thirds of the calories of the diet. The higher the proportion of wheat, or other cereal, in the diet, the greater the care necessary to secure the indispensable elements in order to avoid deficiency diseases. In the United States, it is only where the statistically average diet is not had that the possibility of deficiency diseases arises.

A broad survey of modern knowledge of nutrition, in a country with the agricultural characteristics of the United States, indicates that nutritional security in the diet is to be sought in the milk supply and that wheat (and other cereals) ought to serve us as fuel food. To consume our bread as whole wheat bread instead of white bread would make no essential contribution to the national health, and would not be in the interest of national economy. American agriculture is based on the diversified diet, and any step in the direction of vegetarianism is not in the economic interest of the present population as related to land area.

Apart from nutritional considerations, the place of wheat in the diet depends on taste, custom, convenience, and price. Wheat is now one of the cheapest foods and under conditions of prosperity there is little incentive further to cheapen the diet by increasing the consumption of wheat. Other things being equal, there is little reason to expect that consumption of wheat may be expanded by appeals on behalf of producers. With national income where it stands and a wide diversity of foodstuffs freely available, the present place of wheat in the diet has been arrived at through a series of adjustments and interactions which are not likely to be notably modified in the near future.

This issue is the work of Alonzo E. Taylor

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 5 MARCH 1929

A WEIGHTED SERIES OF CASH WHEAT PRICES AT WINNIPEG

THE range of cash wheat prices at Winnipeg is a wide one at any time. Broad comparisons of short-time movements of Canadian prices with the movement in other countries are considerably facilitated if a price series adequately representative of the range of prices is available for each market or country. Canadian wheat crops vary widely in their composition by grades from year to year, so that the prices of any single grade are not consistently appropriate for such comparisons; and futures prices are also unsatisfactory. This study presents a series of weekly weighted average cash wheat prices at Winnipeg which seems, with certain limitations, to be satisfactorily representative of the range of Winnipeg prices. It is based upon weekly averages of cash closing prices on the Winnipeg Exchange, weighted by inspections of wheat by grades at Winnipeg.

The series is subject to several qualifications arising from the price statistics and the weights used. Of these qualifications the most important is that the volume of weekly sales at Winnipeg cannot be expected to conform precisely in its composition by grades with the composition of weekly inspections by grades. The series seems least reliable as an indicator of the true course of Winnipeg cash prices in the months of August and September, when inspections are small and when they may change radically in their composition by grades. It is less satisfactorily representative of terminal prices throughout all Canada than of terminal prices at Winnipeg, because prices and inspections of wheat sold at Vancouver are not included. The defects of weighting by Winnipeg inspections are, however, less significant in weekly weighted averages than they would be in monthly or annual weighted average prices.

STANFORD UNIVERSITY, CALIFORNIA

March 1929

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

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Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.
Published by Stanford University for the Food Research Institute.

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FOOD RESEARCH INSTITUTE

STANFORD UNIVERSITY, CALIFORNIA

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The Food Research Institute was established at Stanford University in 1921 jointly by the Carnegie Corporation of New York and the Trustees of Leland Stanford Junior University, for research in the production, distribution, and consumption of food.

A WEIGHTED SERIES OF CASH WHEAT PRICES AT WINNIPEG

I. INTRODUCTION

Wheat is not a homogeneous commodity. Within any terminal market, much less within a given country, there is never at any time a single cash wheat price. Rather there is a wide range of cash prices occasioned by differences in composition and merchandising position of particular lots of wheat. On January 21, 1929, for example, cash closing prices were quoted on the Winnipeg Grain Exchange for twenty-two distinct types and grades of wheat of identical position — in store at Fort William and Port Arthur; the price range was from 75⅜ to 123⅛ cents per bushel, and some grades were not quoted. Some such situation may be observed in any important wheat market on any day. As we have frequently had occasion to say, the wheat price at any time is not a point but a range.

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The most comprehensive description of changes in wheat prices in Canada, as in other countries, can be obtained by presenting the prices of all important grades, either as ranges or as averages. For special purposes this procedure is desirable, in spite of the labor entailed. But so numerous are the grades, and so great are their individual variations in quantity and price from year to year, that such a description is too complex to yield a clear picture of the general movements of wheat prices even in a single market. Moreover, it does not lend itself to inter-market comparisons or to general analysis of movements in world wheat prices, for the ranges in different markets are so wide and overlapping that significant changes in price relationships are obscured. In order intelligently to follow the course of wheat prices, or to analyze the causes of their variations, it is necessary to have some condensation of this range of prices or to select some significant but narrower range within it.

For certain purposes the price of a representative grade—expressed either as a range or as an average—is most serviceable. But in Canada, as in other countries, the wheat crops differ greatly from year to year with respect to the proportions of the various grades of wheat marketed. In one year the great bulk of the Canadian crop may lie within the so-called "statute" grades, Nos. 1, 2, and 3 Northern Manitoba; there may be little of the "commercial" grades, Nos. 4, 5, 6, and feed. In another year the commercial grades, which are always cheaper than the statute grades, may predominate; and in still another year the tough grades, which are cheaper grade for grade than the statute and commercial grades, may bulk large. The crop year 1922–23 was characterized by an extraordinary proportion of wheat grading No. 1 Northern, with very little wheat of tough or commercial grades. In 1925–26, 1926–27, and 1927–28, the proportions of wheat grading tough were exceptionally large. In the current year, 1928–29, there is an exceptionally large proportion of the commercial grades and relatively little either of No. 1 Northern or of tough grades. Under these circumstances, it is obvious that a price series of No. 1 Northern Manitoba alone cannot accurately reflect changes in the general level of Canadian wheat prices; for in some years No. 1 is much more a premium wheat than in others. Nor will a price series applicable to any other single grade serve, for no single grade constitutes the same proportion of the crop in every year.

Since one cannot feasibly compare ranges in wheat prices in the world's leading markets on account of the very width of the ranges, the best alternative is to secure, for each of the leading markets in each of the leading exporting and importing countries,

a single price series reasonably representative of the range of wheat prices in those markets. A weighted price comprehending several grades, or all wheat sold, in a single market, is needed as a supplement to or a substitute for the price of a representative grade.

In an earlier issue of WHEAT STUDIES[1] we have presented a weekly series of British parcels prices, which we regard as reasonably representative of the range of import wheat prices in the United Kingdom, the leading international wheat market. The U. S. Department of Agriculture currently compiles a weekly weighted average price of car-lot sales of all classes and grades of wheat in the six leading terminal markets of the United States; and this series, though it takes no account of the prices of the important fraction of the wheat crop sold in the Pacific Northwest, may be regarded as reasonably representative of the range of terminal prices in the United States. Here we present a comparable but not identical series for Canada, the principal wheat-exporting nation of today. This series of weekly weighted average prices of wheat at Winnipeg may be regarded, with appropriate qualifications set forth below, as reasonably representative of the range of terminal prices in Canada. We offer this series not as the best for all uses, but as one that is valuable for certain purposes simply because it is more generalized than any other weekly series now available. Moreover, the problems involved in reaching such a series are of interest in themselves. In the absence of price and inspections data for earlier years, this series begins with August 1922.

II. CONSTRUCTION OF THE SERIES

In order to simplify discussion, we may assume that the sole reason for constructing a weighted price of Canadian wheat is to secure some way of measuring changes in the course and general level of Canadian wheat prices over short as well as long periods. What existing prices series, then, can be made to serve the purpose?

THE SELECTION OF PRICES

Producers' prices, as now compiled, are unsatisfactory. In the United States, producers' prices are now obtained for the fifteenth (prior to December 1923, for the first) of each month; but in Canada only one estimate of producers' prices is obtained each year, at the end of December. Hence short-time fluctuations in Canadian prices cannot be followed by reference to producers' prices.

Export prices, weighted, may be obtained by reference to quantities and values of monthly exports of wheat. Such a series is of value for some purposes; but it cannot be made to show price movements from week to week.

Futures prices at Winnipeg are satisfactory for many purposes. But they are of limited utility for purposes of measuring changes in the course and general level of Canadian wheat prices. Futures prices are not continuous; hence in order to show the price movement over a considerable period of time, some splicing or adjustment of the futures prices to one another is required. Thus prices of (say) the May future may at some point be "spliced" to prices of the July, prices of the July to prices of the October, and so on. Such splicing may on occasion misrepresent the actual cash price movement, particularly when the near future closes at a large premium over the distant, or the distant over the near. Again, the Winnipeg future is tied more closely to the higher than to the lower grades of wheat. Only No. 1 Northern Manitoba or better quality is deliverable on futures contracts without discount; No. 2 is deliverable at a discount of 3 cents; No. 3 at a discount of 8 cents; No. 4 at a discount of 21 cents (23 cents from 1922–23 to 1925–26). Hence, at least in the futures closing months, the price level shown by futures quotations will be relatively higher in years when the deliverable grades happen to be scarce than in years when they happen to be plentiful, even if the total Canadian wheat crops are of the same size and the levels of international wheat prices are identical.[2]

[1] July 1928, IV, No. 8.

[2] See also below, pp. 189–91.

A continuous weekly wheat price series most nearly representative of the range of Canadian prices is to be sought in cash prices recorded on the Winnipeg Grain Exchange. That exchange handles a far larger volume of cash sales of wheat than Vancouver, which is the only other important cash wheat market of Canada; Winnipeg, indeed, is probably the greatest single cash (not sample) wheat market in the world. If data were available to show for each day of the year the total volume of cash wheat sales in Winnipeg in relation to the total value of wheat sold,[1] daily weighted average prices could be computed that would be truly representative; and satisfactory weekly, monthly, and annual weighted average prices could be obtained. Such prices would be representative of the range of Canadian terminal cash wheat prices except in so far as other cash transactions, at different prices, occurred in the other terminal markets. But records of the daily volume and value of sales, or of each particular sale, at Winnipeg are not available. Hence one must seek in some other way whatever may appear to be the nearest approach to the weighted price series that would be obtained if these data could be secured.

The chief difficulty involved in obtaining a price series at all times representative of the range of Canadian terminal prices lies, as we have seen, in the fact that the Canadian crops contain wheat of the several grades not in identical, but in widely varying, proportions from year to year. Analysis of official data on inspections in the Western Division illustrates the point.

There are two administrative inspection divisions in Canada, the Eastern and the Western. The Western Division includes such important wheat-receiving centers as Fort William and Port Arthur, Winnipeg, Duluth, Moose Jaw, Medicine Hat, Saskatoon, Edmonton, Calgary, and Vancouver; the Eastern Division includes Montreal, Toronto, and all other points east of Fort William and Port Arthur. Comparatively little Canadian wheat receives its primary inspection either at Fort William and Port Arthur or at any point in the Eastern Division, though a good deal of United States wheat is reinspected at Montreal. The annual average quantities of Canadian wheat inspected over the period 1921–22 to 1926–27 were 303.5 million bushels in the Western Division, and only 1.4 million in the Eastern Division.[2]

The quantitatively important grades of wheat inspected in the Western Division are Nos. 1, 2, and 3 Northern Manitoba; commercial grades Nos. 4, 5, 6, and feed; and "no grade"[3] hard red spring wheat. Table 1 (p. 178) shows that the combined total of these grades has not fallen below 91.6 per cent of total inspections in any of the past seven years. In all years except the present, feed wheat and No. 6 were unimportant, and No. 5 was of little importance except in 1924–25. The category "others" includes numerous grades, chiefly straight grade or tough durum wheats; smutty hard red spring; rejected and/or sprouted hard red spring; Alberta and mixed red winter; No. 1 Hard, the highest quality of Canadian wheat;[4] and grades of hard red spring called Nos. 4, 5, and 6 special. The winter wheats, the smutty wheat, and the No. 1 Hard were never, in these years, present in appreciable amounts. In 1922–23, rejected and durum predominated in the "others" category; in 1923–24, rejected and the "special" grades; in 1924–25, durum; in 1925–26, rejected and durum; in 1926–27, sprouted and durum; in 1927–28, durum. The classification "special" was employed only in 1922–23, 1923–24, and 1924–25, "sprouted" only in 1926–27.

Clearly, therefore, a satisfactory weighted average price of Canadian wheat could be secured (1) if price quotations were avail-

[1] Equally adequate information would consist of a record of individual transactions for each day—the quantity and the price per unit of each sale.

[2] These were primary inspections; the figures do not include reinspections arising either because of protests on grading, or because of changes in grade caused by mixing, cleaning, and/or drying operations conducted principally at Fort William and Port Arthur.

[3] Wheat classified as "no grade" in the inspections returns is further termed either "tough" or "damp," and is actually graded tough Nos. 1 to feed and damp Nos. 1 to feed. "Tough" grades contain from 14.4 to 16.9 per cent of moisture, "damp" grades 17 per cent or over. Grades called "wet" are no longer in use. Since damp types are relatively insignificant in quantity, we may regard "tough" and "no grade" as practically synonymous terms.

[4] This grade of wheat was dropped from the list of inspected grades in 1928–29, on account of continuing scarcity of offerings.

able for the seven straight and the no grade or tough grades of wheat listed above as quantitatively important, and (2) if one could devise some appropriate system of weighting that would correspond fairly closely to the actual sales of cash wheat on the Winnipeg Exchange. A weighted weekly price series must prove unrepresentative to the extent that certain grades of wheat actually sold are disregarded in the computation, and to the extent that the weights employed fail to represent the quantities of the various grades that are sold week by week.

subtracting from the weekly average prices of the straight grades of the same designations the weekly average discount of tough No. 3 under straight No. 3. This procedure is by no means exact; but from some points of view it seems appropriate. The lower grades of tough wheat seem ordinarily to sell at smaller discounts below the straight grades than do the higher tough grades below the higher straight grades of the same number. In 71 per cent of the weeks for which weekly average prices are shown in Appendix Table I, the discount of No. 3 tough under No. 3 straight was smaller than

TABLE 1.—PERCENTAGES OF SPECIFIED GRADES OF HARD RED SPRING WHEAT TO TOTAL INSPECTIONS OF ALL WHEAT IN THE WESTERN DIVISION, ANNUALLY FROM 1922–23*

Classification	1922–23	1923–24	1924–25	1925–26	1926–27	1927–28	1928–29[a]
No. 1 Northern	65.6	37.3	19.3	22.3	9.2	.9	1.4
No. 2 Northern	16.8	25.8	18.3	27.1	17.5	7.7	12.0
No. 3 Northern	9.3	22.9	18.6	13.9	7.8	22.3	19.5
No. 4 Northern	.8	5.2	16.3	3.1	3.2	12.3	19.5
No. 5 Northern	.2	1.2	8.1	.9	1.4	5.0	17.1
No. 6 Northern	.1	.4	3.2	.2	.9	2.9	15.8
Feed	.1	.6	1.3	.0	.4	1.2	6.1
No grade[b]	2.6	1.0	11.7	28.6	51.2	43.1	1.6
Total above	95.5	94.4	96.8	96.1	91.6	95.4	93.0
Others[c]	4.5	5.6	3.2	3.9	8.4	4.6	7.0
Grand total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Data from *Canadian Grain Statistics*, for September–August crop years.

[a] September–March.

[b] Hard red spring wheat of grades Nos. 1 to feed, but containing a higher proportion of moisture than those grades.

[c] Includes numerous grades of winter, durum, and hard red spring wheat, chiefly rejected, sprouted, and special grades of hard red spring and durum.

Price quotations are readily available for straight grades Nos. 1, 2, 3, 4, 5, 6, and feed; and also for tough Nos. 1, 2, and 3. Weekly averages of daily prices of these grades since August 1922 have appeared in *Canadian Grain Statistics*, an official publication. These are prices of wheat in a given position, in store at Fort William and Port Arthur. These statistics are given in Appendix Table I. There are as many grades of tough as of straight wheat; but prices of tough Nos. 4, 5, 6, and feed are not published in any journal available in our files, though they could be secured at Winnipeg.

Since it seems desirable to include in a weighted average price the prices of these lower tough grades, we have estimated the prices of tough Nos. 4, 5, 6, and feed by

the discount of No. 1 tough under No. 1 straight; it was larger in 23 per cent of the weeks, and the same in 6 per cent of the weeks. We have tested our procedure for the year 1927–28, in which lower grades of tough wheat bulked relatively largest in quantity, by employing our derived prices and, alternatively, actual prices secured from daily spread cards at Winnipeg. The weekly weighted prices did not differ by a full cent per bushel in any week of the year. In other years the weights ascribed to our estimated prices of tough grades happen to be relatively lighter than in 1927–28, so that our procedure seems sufficiently accurate.

With these estimated prices of tough Nos. 4, 5, 6, and feed, we have available weekly averages of daily cash closing prices on the

Winnipeg Exchange for fourteen grades of wheat. It might appear desirable to include in a weighted average the prices of other grades, particularly of durum wheat. The proportion of durum inspections to total inspections in the Western Division has increased considerably in recent years; and if, as some observers think probable, durum wheat production should show a large relative increase in the future, a weighted average price of Canadian wheat which excludes durum would lose some if its significance, or would at least become decreasingly representative. But since inspections of the fourteen grades whose prices we employ have always exceeded 91 per cent of total inspections, omission of the prices both of durum and of less important grades is not a serious matter; and it is justifiable partly because computation would be made unduly complex if the several grades of straight and tough durum were taken into account.

Weighting

In default of records of the weekly volume, by grades, of the actual transactions in wheat on the Winnipeg Grain Exchange, the weighting of Winnipeg prices must be based upon primary inspections by grades, either in the Western Division as a whole or in Winnipeg alone. No account need be taken of what we may call secondary inspection, which takes place when wheat is unloaded from the terminal elevators at Fort William and Port Arthur to boats and cars for eastward shipment. The wheat dealt in on the Winnipeg Exchange is usually of the grade determined by primary inspection, though some warehouse receipts carry notations of grade after mixing has taken place, and some wheat is sold before official inspection has occurred and/or before warehouse receipts have been issued upon it.

Inspections data appear appropriate for use in weighting only on the assumption that the volume of each grade of wheat sold each week on the Winnipeg Exchange conforms roughly to the volume of each grade of wheat inspected in that week. Clearly the assumption is not in exact accord with the facts. Cash wheat sales on the Winnipeg Exchange consist chiefly in the purchase and sale of warehouse receipts, each of which bears the equivalent of the statement that a certain quantity of wheat of a specified grade has been received at a given warehouse, normally at Fort William or Port Arthur. Other sales are made of wheat "on track" (that is, in railway cars not yet inspected but in or near an inspection point) and of wheat "billed and inspected" (that is, inspected and on its way from Winnipeg to the head of the lakes, but against which warehouse receipts have not yet been issued). All prices resulting from these sales, however, are prices of wheat in store at Fort William and Port Arthur.

It is readily conceivable that 100,000 bushels, say, of each of ten grades of wheat might be inspected in a given week, but that the several types of sales might not amount to precisely 100,000 bushels of each grade. There can be no possibility of *precise* concordance of sales by grade and inspections by grade. The two principal causes of divergence would seem to be (1) the possibility that owners of warehouse receipts sometimes choose to press offers of one grade and withhold offers of another; and (2) the fact that mixing operations result in sales different in their composition by grades from the composition of primary inspections by grades.

Nevertheless, since we are here concerned chiefly with the construction of a *weekly* weighted average, differences between the composition of cash sales by grade and the composition of primary inspections by grade seem not to be of major significance.

Throughout a given crop year, the situation is probably about as follows. If a large proportion of wheat grades No. 1 at Winnipeg and a small proportion grades No. 4, in any week, then warehouse receipts issued and sold in that week will tend to apply to No. 1 more than to No. 4 in something like the same proportion as inspections consist of these grades. On the whole, within a given crop year, the proportions which inspections of the various grades bear to total inspections tend to remain fairly constant from week to week. Although there are some fairly abrupt shifts, especially in the period of transition from old to new crop, inspections do not consist entirely of No. 1 in one week, entirely of No. 6 in another;

in their composition by grades, physical receipts of wheat at warehouses and warehouse certificates issued against them necessarily differ only slightly from inspections. It is difficult to see why sales of warehouse receipts applicable to particular grades should in one week be negligible if inspections of those grades were large in proportion to inspection of other grades. The more probable view is that, when physical receipts of *all* grades are largest in the October–November crop movement, then sales of *all* grades are somewhat reduced, and that sales of *all* grades tend to exceed physical receipts and inspections in later months when the peak of the marketing movement is passed. In so far as drying and mixing are practiced, and warehouse receipts are sold applicable to grades emerging from the process, there exists a further discrepancy between primary inspections by grades and sales by grades, though perhaps not a large one because mixing does not result in extreme changes in grades.

One may reasonably assume, in short, that if in a given week inspections at Winnipeg consist of definite proportions of each grade, then sales by grade on the Exchange will tend to approximate these proportions, though the correspondence cannot be expected to be exact. If the proportions of sales by grades and inspections by grades tend to correspond each week, then weekly average prices may appropriately be weighted by inspections. In so far as, over a year, sales are spread more evenly than inspections, this would have more serious effects on a weighted *annual* average terminal price than on a weighted *weekly* average price: for if, in a given year, low prices were more heavily weighted by inspections than by sales, and high prices by sales than by inspections, then a weighted average based on sales would be higher than one based on inspections. The difference would be the greater if price fluctuations were wide.

Partly because Winnipeg cash wheat sales probably correspond more closely with Winnipeg inspections by grades than do Winnipeg cash wheat sales and inspections by grades throughout the Western Division, we have employed Winnipeg inspections for weighting Winnipeg prices. In so far as one seeks a weighted average terminal cash price representative of the whole Canadian crop, the use of Winnipeg inspections alone is defective. In some years a distinctly large proportion of the Canadian crop, mostly from Alberta, moves westward to Vancouver.[1] Sometimes, as in 1928–29, the Alberta crop, including the portion moved westward, may consist more largely of the lower grades of wheat than do the crops of Saskatchewan and Manitoba. Wheat moving westward is inspected at western points, principally Calgary, Edmonton, and Vancouver, and not at Winnipeg; the terminal price of this wheat is recorded principally at Vancouver, though the relationship between the Vancouver and the Winnipeg markets is close.[2]

Now in order to obtain the most representative weighted average terminal price of Canadian wheat, prices at Winnipeg should be weighted by sales (or inspections) there, and prices at Vancouver by sales (or inspections) there, and the two series combined. But Vancouver is only beginning to assume large importance; Vancouver cash prices for a period of years are not readily available; and to separate inspections of wheat moving to Vancouver from inspections of wheat moving to Winnipeg is at best a time-consuming and necessarily an inexact procedure. Consequently

[1] The relative importance of the Vancouver market in relation to the Winnipeg market is suggested by the following figures, which show for the past seven years, in million bushels, August–July wheat receipts at Fort William and Port Arthur in contrast with receipts at Vancouver (and Prince Rupert after October 1, 1926). Data are official.

	Fort William, Port Arthur	Vancouver
1922–23	246.6	16.9
1923–24	297.4	52.0
1924–25	157.0	25.5
1925–26	261.8	53.8
1926–27	254.0	43.6
1927–28	261.3	93.1
1928–29[a]	262.4	67.7

[a] August–February.

[2] Cash wheat transactions at Vancouver are still made on the basis of the Winnipeg future (so much over or under the future for each grade of cash wheat, just as occurs at Winnipeg), despite the existence of a new futures market. No. 1 Northern cash wheat may sell at Vancouver either at a smaller or at a larger premium over the Winnipeg future than it sells, on the same day, at Winnipeg. This year No. 6 wheat has brought higher prices at Vancouver than at Winnipeg, because Oriental demand for this grade has been active, while European demand has been less so.

this procedure is not feasible; and one is left with the alternatives of weighting Winnipeg prices either by inspections at Winnipeg alone or by inspections throughout the Western Division.

In effect, the use of Winnipeg inspections results in a weighted price not accurately representative of terminal prices in all Canada. But the use of inspections in the Western Division would result in a price not accurately representative of terminal prices recorded at Winnipeg. In view of the fact that Winnipeg is still by far the leading cash wheat market of Canada, more seems to be gained in obtaining the best possible Winnipeg weighted price series than in seeking to render this price series accurately representative of terminal prices throughout Canada by means of what is at best a compromise procedure, the weighting of Winnipeg (excluding Vancouver) prices by inspections in the Western Division. One may be reasonably certain that Winnipeg prices weighted by Winnipeg inspections will yield a weighted price series only a cent or two different from a series computed either from Winnipeg prices and Western Division inspections, or from Winnipeg and Vancouver prices weighted by Winnipeg and Calgary, Edmonton, and Vancouver inspections.

Weekly inspections at Winnipeg since August 1922 are shown in Appendix Table II, in terms of cars inspected. As we have seen, weekly average prices are available for fourteen grades, including derived prices for commercial tough grades 4, 5, 6, and feed. As appears from Appendix Table II, published data on inspections do not show fourteen grades, but eight: all tough wheat, whatever the grade, is listed as no grade. In order to ascribe weights to the prices of the seven grades of tough wheat, it has been necessary to estimate what percentage of all no grade wheat graded No. 1 tough, and so on for the lower grades.

Our basis of estimation is the assumption that each grade of tough wheat constituted the same percentage of all tough wheat inspected as each straight grade constitutes of all straight wheat inspected. This assumption is probably not in precise accord with the facts, but there seems no reason to suppose that weather conditions would give rise to higher moisture content in any one grade of wheat than in any other. In order to shorten the calculation of the percentages to total inspections grading tough of each grade, we have employed monthly inspections in the Western Division rather than weekly inspections in Winnipeg. The differences between weekly and monthly figures, and between Winnipeg and Western Division inspections, seem too small appreciably to affect the weighted averages.

In the final computation, the weekly average price of each of the fourteen grades is multiplied by the percentage borne by inspections of each grade to the total inspections of the fourteen grades. The sum of the fourteen products thus obtained for each week is divided by the total weight; this weight is 100 per cent, so that division of the product-sum by the weight consists merely in shifting the decimal point.

All Canadian price figures shown in Appendix tables or graphically in charts are presented in terms of Canadian currency. The labor of conversion to United States currency seems unnecessary because Canadian exchange has remained close to par in all of the years for which price statistics are here presented. As judged by comparison of monthly weighted average export prices converted and unconverted, conversion has not altered the price by more than one cent per bushel since July 1924. From January 1923 to July 1924, however, depreciation of the Canadian exchange caused prices expressed in Canadian currency to exceed prices expressed in United States currency by more than one cent in most months, but never by more than three cents.

III. QUALIFICATIONS

We have already noted some features in the construction of our weekly weighted series which prevent one from placing perfect confidence in it as representative of the range of terminal cash wheat prices either in Winnipeg or in all Canada. These and other shortcomings merit examination to reveal what qualifications pertain to the

series and with what reservations it should be used.

In brief, the series falls short of being perfectly representative of the range of cash wheat prices at Winnipeg (1) because the official data on prices and inspections are deficient for a few weeks; (2) because the series is based upon weekly averages of daily cash closing prices, rather than upon prices of all cash sales; (3) because prices of certain grades and varieties of wheat sold on the Winnipeg market are not included; (4) because prices of certain grades employed in construction of the average are estimated; (5) because the weighting factors to be applied to all prices of tough wheats are estimated; and, most important of all, (6) because the weighting factor, Winnipeg inspections, cannot be expected to correspond with the proper but unknown weighting factor, actual volume of cash sales, especially in the months of August and September. The number of qualifications is more impressive than their significance.

The series falls short of being perfectly representative of the range of Canadian terminal wheat prices for the reasons listed above, and in addition because neither prices nor quantities of wheat sold at Vancouver are taken into account.

Minor Imperfections

The first four of the imperfections noted are of minor importance and can be dismissed without extended discussion.

1. For several weeks in the seven-year period considered, weekly average price quotations for particular grades of wheat were either not available in the primary source, *Canadian Grain Statistics,* or were probably incorrect as there reported. Missing figures were for the most part supplied from the *Grain Trade News* (called *Market News* in the earlier years of the period). Occasional interpolations were necessary, but these could be made with confidence in view of the consistency shown by spreads in preceding and following weeks. Palpable errors in quotations, which readily appeared upon the calculation and plotting of spreads, were corrected in most instances by reference to the same sources. Trifling errors doubtless remain embodied in the figures shown in Appendix Table I; we have made no effort to check in detail the weekly averages shown in *Canadian Grain Statistics* with averages secured directly from daily price quotations. Such errors cannot be of importance in their effect upon the weighted averages.

Data on weekly inspections at Winnipeg were missing for a few weeks, notably in August and September 1922 and in August 1923, as appears from Appendix Table II. Our procedure in filling gaps in these months was to employ data on monthly inspections in the Western Division. Thus the weights applied to weekly prices in August 1922 were identical in each of the four weeks of that month; and so with weights applied to the prices in September 1922 and August 1923. For two other weeks (those ending October 15 and December 31, 1923) it was necessary to obtain inspections data by interpolation. In so far as inspections at Winnipeg differed in their distribution by grades from Western Division inspections, and in so far as the distribution by grades changed from week to week, the weighted average prices for August-September 1922 and for August 1923 are likely to misrepresent the facts. In general the weighted average prices in the months of August and September of each year—the period of transition from one crop to another—are to be regarded as less dependable than the prices in other months, for reasons set forth below.[1]

2. The use of weekly averages of daily cash closing prices rather than prices of all cash sales is not of great significance, but may result in showing weighted averages too high in some weeks and too low in others. The daily cash closing price of each grade is the price of the last sale of the day on the Exchange. At some periods prices rise rapidly and consistently from day to day and from week to week, or fall similarly; usually the prices of one grade fluctuate in the same direction and to much the same extent as prices of other grades, though changes are more frequently in the same direction than of the same amount. During a period of sustained rising prices, the cash closing price each day probably tends to be higher than the prices recorded

[1] See p. 185, paragraph 3.

in the earlier hours of the day. If this happens each day for several weeks, the weighted average price during those weeks must be higher than would be the case in weekly average prices made up not from daily cash closing prices, but from prices of each sale each day weighted by quantities sold. In a period of sustained falling prices, the reverse would be true because the daily cash closing price would tend each day to be lower than the prices recorded in the earlier hours of the day. The net effect of employing daily cash closing prices is thus to show weekly weighted average prices sometimes too high and sometimes too low. From available data one cannot estimate how much too low or too high the weighted averages may be; but, since sustained upward or downward movements are uncommon, one may suppose that the effect is unimportant. In most weeks of any year, prices move upward in some days and downward in others.

3. The omission from the weighted average of prices of various grades of wheat sold on the Winnipeg market, notably durum and rejected hard red spring, is not a serious matter. These grades do not bulk large in the total quantities of wheat inspected in any year; consequently they cannot bulk large in the sales on the Exchange. They have never amounted to more than 8.4 per cent of total inspections in the Western Division. The effect of their omission is to raise the weighted average price very slightly above what it would be if they were included, for the several grades of rejected hard red spring and of durum wheat tend to sell for less than the equivalent grades either of straight or tough hard red spring wheat.

4. Included in the calculation of the weighted average are estimated prices of Nos. 4, 5, 6, and feed. As we have seen, these prices as estimated are perhaps slightly too low in most weeks of the period covered. If so, the weighted average prices are slightly too low, though the amount is not susceptible of measurement and is unquestionably small because the weights assigned to these grades happen always to be relatively small. To employ unduly low prices of these grades tends to correct the upward bias caused by disregarding the prices of the grades mentioned in the preceding paragraph.

Estimated Weights for Prices of Tough Wheats

5. Since weekly inspections data yield only a single figure for no grade wheat covering the quantity of the several grades of tough, damp, and wet wheat, whereas price statistics are quoted or may be estimated for seven grades of tough wheat, it was necessary to estimate how much of the no grade wheat was classified as of each of the grades tough No. 1 to tough feed. Estimates were based on the assumption that the total no grade wheat was actually distributed among the various tough grades in the same proportions, week by week, as the total straight-grade wheat was distributed among the several straight grades. This assumption seems, on the whole, a reasonable one, and we see no reason for preferring another. But it can hardly be invariably correct, and we know of no method of testing its accuracy. Hence it is probable that the weighted averages are rendered somewhat inaccurate by inexactness in the estimated weights applied to prices of tough wheat.

The inexactness is enhanced by the fact that, in order to shorten the computations, the percentage weights applied to prices of the several tough grades were derived by the use of monthly inspections in the Western Division rather than by weekly inspections at Winnipeg. But we see no reason to suppose that the errors introduced into the weighted averages by these estimates are large in any year, or that a consistent bias in either direction is created. The possibility of error is greatest in the years 1925–26, 1926–27, and 1927–28, when wheat classified as no grade constituted far larger proportions of the total inspections than in other years.

Weighting by Inspections Rather Than Sales

6. The practice of weighting by Winnipeg inspections rather than by the volume of actual sales is potentially the largest source of error, and calls for more extended comment. Undoubtedly the proportion of total inspections grading No. 1 will not in any

week correspond precisely to the proportion of total sales of No. 1 wheat; and so with other grades. There may be periods several weeks in length when sales of any grade are either more or less in proportion to totals than are inspections of identical grades in proportion to totals. But on the whole it seems probable that divergences are not large. The crop has to be moved to export rapidly; it is handled by many individuals and organizations; and there is no reason to suppose that, if price adjustments are quickly made, either buyers or sellers will consistently cause sales of a particular grade to be small in relation to inspections and receipts of that grade.

The present year perhaps furnishes an extreme example. Inspections of No. 6 wheat ran exceptionally heavy, but this wheat tended to move to export rather more slowly than other grades, at least in the earlier weeks of the season. One may suppose that, for a time at least, sales of No. 6 on the Exchange were smaller in proportion to total sales than were inspections of No. 6 wheat to total inspections. Even this is not clear in the absence of data on sales, but the inference seems reasonable. The effect on the weighted average price would be to render it too low in weeks when sales of No. 6 were smaller in proportion than were inspections, too high in weeks when, after price readjustment, sales of No. 6 became larger in proportion than inspections of No. 6.

Evidence respecting similar occurrences applicable to other grades in other years is not available. Weighting by inspections probably does not create a consistent bias in either direction, for no single grade of wheat can consistently remain unsold over a period of years if it is inspected and received at terminal elevators. Presumably the bias is of the same sort as that created by the use of daily cash closing prices: in some weeks the weighted average is made too high, in others too low; but one cannot ascertain in which direction the bias operates in particular weeks. Nor can one measure the probable amount of the inaccuracy in reflection of the range of Winnipeg prices caused by weighting by inspections rather than sales. Doubtless it varies from week to week. In our judgment it cannot be enough markedly to affect the course of weighted average prices shown by our series; but the possibility that it may do so constitutes the chief reason for not regarding the series as fully representative of terminal cash wheat prices at Winnipeg.

However, in so far as wheat mixed in private terminal elevators is sold on the Exchange, our system of weighting by primary inspections causes the weighted average prices to run somewhat too low. Mixing is practiced chiefly in order that an elevator company may have more wheat of the higher grades, and less of the lower, to sell. Hence, from this cause alone, the proportion of sales of upper grades of wheat tends to be larger than the proportion of primary inspections of the upper grades; and the reverse is true of the lower grades. We have no way of measuring the effect upon our price series of the practice of mixing. But in view of the fact that much wheat is sold unmixed, and that extreme changes in grade through mixing are unlikely,[1] we assume that the weighted average prices are only a trifle lower than they would be if mixing were not practiced.

Again, although we employ Winnipeg inspections as weights, not all of the wheat inspected at Winnipeg is sold on the Winnipeg Exchange, while a given parcel of wheat may be sold more than once in the course of a week. Some wheat inspected at Winnipeg may pass directly to Pool or other elevators at Fort William and Port Arthur, and may be sold directly (by cable) to a foreign buyer, or even consigned unsold, without any record of the cash transaction being made on the Exchange. The absolute amount of wheat so handled by the Pool may constitute a fairly large fraction of the Canadian crop. The use of inspections as the weighting factor would lead to decidedly inaccurate results if there were good reason to suppose that wheat so sold or consigned consisted predominantly of only one or two grades; for in this event the prices of these grades would be given more weight by the use of inspections than

[1] Adequate information on the results of mixing are difficult to obtain. Our conclusion that extreme changes in grade are unlikely is based upon evidence contained in the *Report of the Royal Grain Inquiry Commission,* Ottawa, 1925, pp. 90–91.

by the use of sales on the Exchange. But there seems no reason to suppose that any particular grade is selected for direct sales; and we have therefore assumed that this factor does not disturb such general correspondence as otherwise exists between inspections by grades and sales by grades. The same assumption seems reasonable to apply to the matter of resales of particular lots of wheat: one can see no good reason why any one grade should be resold on the Exchange relatively more than any other, at least to an appreciable degree.

Here we are seeking a single price series adequately representative of the actual range of cash wheat prices at Winnipeg, and so far as possible in Canada. We are not concerned to secure what might be significant for some purposes—a price series accurately representative of the range in export prices. The shipment of wheat consigned or unsold is in itself an interesting and important matter. But we are unable to perceive that such shipments seriously prejudice the principle of weighting Winnipeg prices by Winnipeg inspections in order to reach a cash price series adequately representative of the range of terminal cash wheat prices at Winnipeg.

August and September are the months of the year when our weekly weighted average prices seem least likely to correspond to a weighted average based upon actual sales. In these months inspections are always relatively small in absolute amount; and they consist of old-crop wheat in the earlier weeks, of new-crop wheat in the later weeks. Partly because the total inspections are small, so that relatively heavy receipts of any given grade are possible, and partly because new-crop wheat may grade quite differently from old-crop, weighting by inspections may give rise to anomalous movements in the weighted average price. Thus, to take the most extreme example, a marked change in the distribution of inspections occurred between the last week of August and the second week of September 1924. In the week ending September 1, only 18.2 per cent of the inspections graded No. 1; but in the following week 67.9 per cent graded No. 1. Thus the relatively high price of No. 1 received a much heavier weight in the second week, while the lower prices of Nos. 2, 3, and 4 received lighter weights; and as a result the weighted average price advanced more sharply than the prices of any single grade. Apparently the percentage of inspections grading No. 1 each year tends sometime in August or September suddenly to increase, and thereafter to decrease more gradually; hence the weighted average price moves sharply upward and then declines. If sales on the Exchange corresponded precisely with inspections, such a movement in the weighted average price would represent the facts. But at this season of the year especially, when so little of the crop is moving, one may suspect that sales by grade may deviate further from inspections by grade than in other months when the movement is larger. Consequently our weighted average price probably is less representative of the general movement of Canadian prices in this period of transition than in other months of the year.

The shortcomings in our series that arise from weighting by inspections rather than actual sales are less important in weekly weighted average prices than in monthly weighted average prices, and the errors introduced into weighted annual averages might be still larger. Inspections are largest in volume early in the crop year, but sales probably tend to be spread out more evenly throughout the year. If low prices prevail early in any year and high prices later, an annual average weighted by inspections will presumably yield an appreciably higher annual average than would be obtained in an average weighted by sales. At best, however, statistical difficulties are encountered in getting highly reliable annual average prices. Since we are here concerned primarily with obtaining a useful weekly series, it is unnecessary to go deeply into the special problems involved in deriving monthly and annual series.

The Series as Representative of Canadian Prices

Our series of weighted average Winnipeg prices is subject to further qualifications as a series representative of terminal prices throughout Canada. Winnipeg is by all odds the dominant terminal market of Canada, but it is not the only one, and in

constructing the series we have ignored other markets than Winnipeg.

Vancouver is the only other important terminal market where sales of cash wheat in Canada are recorded. It has become important only recently, but its importance is increasing.

The relations of Vancouver prices to Winnipeg prices are not consistent from year to year or from week to week; at times all grades sell for somewhat higher prices at Vancouver, at times all grades sell for lower prices; and at times some grades sell for higher prices while other grades sell for lower. Consequently, even if inspections at Vancouver, Calgary, and Edmonton were such that in each week each grade bore the same proportion to total inspections at these points as each grade bears to the total at Winnipeg, a weighted Vancouver price would not correspond with the weighted Winnipeg price. As a matter of fact, inspections of wheat sold at Vancouver do not contain the same proportions of the several grades as are found in Winnipeg, and even if prices at Vancouver and Winnipeg were the same for each grade, a weighted Vancouver price would differ from a weighted Winnipeg price for this cause alone.

It is not feasible to ascertain the amount by which the Winnipeg weighted price falls short of representing a weighted terminal price for Canada as a whole. Probably the difference would not exceed a cent or two; for, though both prices and inspections by grade are not the same at Winnipeg and Vancouver, the differences are not striking. The Winnipeg weighted price is more representative of terminal prices throughout Canada in 1922–23 and 1924–25 than in other years of the period, because wheat sold at Vancouver was relatively smaller in amount in those years.

IV. GRAPHIC COMPARISONS

Our object in this study is primarily to present the series we have constructed, with an explanation of the methods employed and due consideration of the qualifications regarding its use as representative of the range of terminal prices in Winnipeg and in Canada as a whole. Even the presentation of the series is hardly complete without a graphic representation of it in relation to some other available series. Accordingly we submit a few charts which will reveal, among other things, something of the significance of the series of weighted average prices at Winnipeg.

Chart 1 shows weekly average prices of No. 1 Northern, No. 5, and feed wheat at Winnipeg, in comparison with the weighted averages. No. 1 Northern is the highest priced grade sold on the Winnipeg Exchange except for a little No. 1 Hard and a little winter wheat; feed wheat is normally the cheapest grade except for tough feed, some grades of durum, and a few "off" grades, none of which has ever been offered in appreciable quantities.

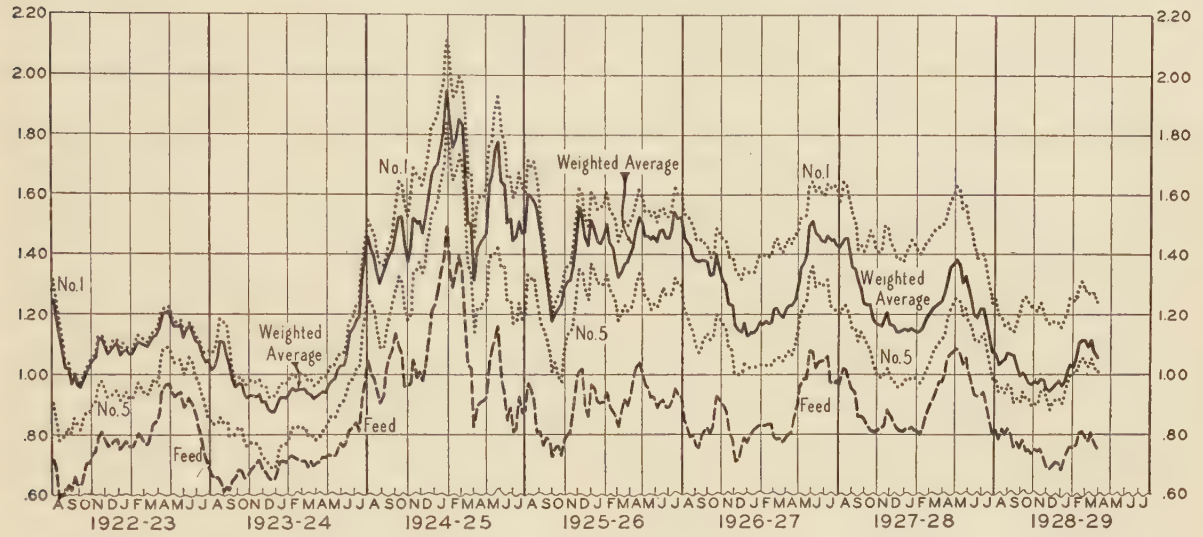
The chart is designed primarily to indicate roughly the position of the weighted average in the general range of cash wheat prices at Winnipeg. The range between the prices of No. 1 and feed wheat is always wide, never below 24 cents and on occasion over 80 cents. The difficulties involved in using price ranges in following the general movement of Winnipeg prices, or of comparing this movement with movements in other markets, are made readily apparent on consideration of the width of the range. One finds some such range in other large terminal markets, though presumably not so wide a one in Argentina and Australia; and the ranges almost always overlap considerably.

The weighted average price changes its position relative to other grades from year to year. Sometimes, as in 1922–23, it is close to the price of No. 1 Northern; sometimes, as in the latest years, it is nearer to the price of No. 5. The manner in which the weighted average price changes its relative position suggests the dangers involved in employing the price of a single grade for the purpose of measuring changes in the general course and level of Winnipeg prices. But this point is made clearer by reference to prices of other grades than No. 1, No. 5, and feed, and particularly by reference to spreads between prices of the various grades.

Chart 2 shows certain of these spreads, measured from the prices of No. 3 Northern. As appears from the chart, the normal relations between prices of the various

CHART 1.—APPROXIMATE RANGE OF CASH WHEAT PRICES AT WINNIPEG, AND POSITION OF THE WEIGHTED AVERAGE PRICE WITHIN THE RANGE, WEEKLY FROM AUGUST 1922*

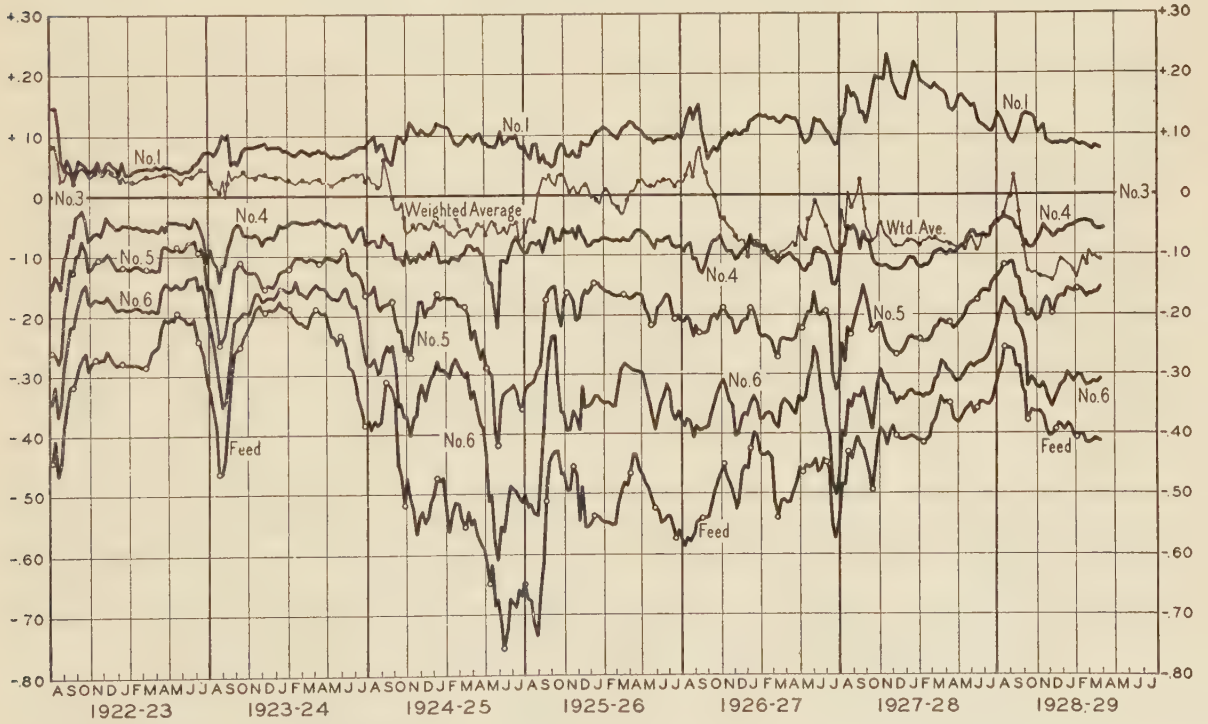
(Canadian dollars per bushel)



* Data from Appendix Table I.

CHART 2.—RELATIONS BETWEEN CASH PRICES OF VARIOUS GRADES OF CANADIAN WHEAT AT WINNIPEG, IN TERMS OF DEVIATIONS FROM THE PRICES OF NO. 3 NORTHERN MANITOBA, WEEKLY FROM AUGUST 1922*

(Canadian cents per bushel)



* Derived from data in Appendix Table I.

grades there shown are as follows. No. 1 Northern always brings higher prices than No. 3 Northern, occasionally only 3 cents more, occasionally as much as 23 cents more. No. 4 always brings less than No. 3 Northern, sometimes only 2½ cents less, sometimes more than 20 cents less. No. 5 has sold between 7½ and 42 cents below No. 3 Northern; No. 6 between 13½ and 61 cents below; and feed between 17½ and 75½ cents below. The prices of No. 2 Northern and of tough Nos. 1, 2, 3, 4, 5, 6, and feed are not shown on the chart, chiefly because inclusion would result in a tangle of lines in the upper part of the range. The prices of No. 2 Northern, however, would fall between the prices of No. 1 Northern and of No. 3 Northern, closer to No. 1 than to No. 3 in most years. The position of the prices of tough grades is less consistent. No. 1 Northern tough always brings lower prices than No. 1 Northern straight, and so with the prices of tough and straight wheat of each particular grade. But tough No. 1 is usually cheaper than straight No. 2, and sometimes cheaper than straight No. 3; tough No. 2 is always cheaper than straight No. 1, tough No. 1, and straight No. 2; it is usually cheaper than straight No. 3, but seldom as cheap as straight No. 4. Tough No. 3 is always cheaper than equivalent or higher grades either tough or straight, and is often as cheap as straight No. 4 but never as cheap as straight No. 5.

In general, there is a fairly consistent step-like relationship between the prices of the straight grades; the prices of these grades never overlap, though spreads vary considerably from year to year. There is also a fairly consistent step-like relationship between prices of the several tough grades. Overlapping in the general Winnipeg wheat price structure occurs only with respect to the relationships of prices of tough grades to prices of straight grades.

The causes of variations in spreads need not detain us here. They rest fundamentally upon three facts. (1) Differences in quality are not consistent, on the one hand because nature imposes differences not taken into account by the statutes defining the three higher grades, and on the other hand because the four lower grades are defined differently for each crop year. (2) The several grades constitute widely different proportions of the crop in successive years. (3) Changes in the wheat price level are probably also influential, causing differentials to be larger when prices are high than when they are low. Furthermore, rules of the Exchange establishing fixed discounts at which grades Nos. 2 and 3 Northern and No. 4 may be delivered on futures contracts may possibly affect the spreads between prices of these grades.

Chart 2 serves further to demonstrate the fact that measurement of changes in the general course and level of Winnipeg wheat prices is necessarily inexact if one is to select the cash prices of any single grade as accurately representative of the range of cash prices. For reasons set forth above, our weighted average price may be regarded as representative of the range within a fairly small margin of error, which is largest in the months of August and September. The chart makes apparent the fact that the weighted average price does not consistently coincide with the price of any particular grade. In 1922–23, for example, the weighted average price was close to the price of No. 1 Northern. In 1923–24 and 1925–26 it was closer to No. 3 than to No. 1; in 1924–25 it lay about midway between No. 3 and No. 4; in 1926–27 and 1927–28 it lay closer to No. 4 than to No. 3; and in the present crop year, 1928–29, it has lain below No. 4, about as near to No. 5 as to No. 4.

To employ the prices of No. 1 Northern as representative of the range of Canadian prices would prove satisfactory enough for the year 1922–23; but in 1927–28 this series would show the general level more than 20 cents too high. To employ the prices of No. 3 Northern as representative would result in levels only about 2–4 cents too low in 1922–23, 1923–24, and 1925–26, but about 5–10 cents too high in 1924–25, 1926–27, and 1927–28, and 10–15 cents too high in 1928–29. A glance at the chart shows clearly enough that the weighted average prices do not consistently correspond with the prices of any particular grade. Errors in measurement of changes in the price may easily exceed 5 per cent, if one chooses to employ the prices of any particular grade as representative.

The changing position of the weighted average prices in relation to the prices of particular grades is naturally explicable largely by reference to data on inspections, since inspections constitute the weights. The following figures show, so far as we are able to estimate, the percentages of all wheat inspected which fell into the higher-priced grades Nos. 1, 2, and 3 and tough Nos. 1, 2, and 3 in the past seven crop years:[1]

Year	Percentage	Year	Percentage
1922–23	94.3	1926–27	78.2
1923–24	86.9	1927–28	56.3
1924–25	64.0	1928–29[a]	33.5
1925–26	90.1		

[a] September–March.

With from 86.9 to 94.3 per cent of the crop falling within the six high-priced grades in 1922–23, 1923–24, and 1925–26, the weighted average naturally stood higher in the range of Winnipeg prices in these years than in others. It has stood lowest in the current year, 1928–29, because inspections have shown the lowest percentage, up to March 1929 only 33.5 per cent, in the six high-priced grades.

Taken alone, the figures given above fail to explain why, with 90.1 per cent of the crop grading straight and tough Nos. 1–3 in 1925–26, and 86.9 per cent in 1923–24, the weighted average was on the whole higher in the range of prices in 1923–24. On reference to more detailed figures, one finds that in 1923–24 very little of the crop graded tough, and more of the crop graded No. 1 Northern. Again, the similar positions of the weighted average prices in 1926–27 and 1927–28 is at first glance inconsistent with the fact that the crop of 1926 contained 78.2 per cent of the six high-priced grades, while the crop of 1927 contained only 56.3 per cent. These figures taken alone suggest that the weighted average prices ought to have stood considerably higher in the range in 1926–27 than in 1927–28. The explanation lies chiefly in the fact that the lower grades (as appears from Chart 2) brought relatively higher prices in 1927–28, and such was the case with the several tough grades, which were plentiful in both years. It should be noted also that the position of the weighted average prices in relation to the prices of No. 3 Northern was higher in 1927–28 than in 1926–27 only in a few months, not throughout the year; and in relation to the prices of Nos. 1, 6, and feed, the weighted average was not so high in 1927–28 as in 1926–27 practically throughout the year.

Thus year-to-year changes in the proportions of the Canadian crop falling within the principal grades, together with partially resultant changes in price differentials, are the chief factors creating the necessity for a weighted average price series if one is to seek something like precise measurement of changes in the course and level of the range of Canadian prices. If each grade constituted an unvarying percentage of the crop in each year, one could measure changes in both the level and the course of Canadian prices with moderate precision by reference to the prices of a single grade. But even in this event, only moderate precision would be possible for price relationships within the range would presumably shift from year to year partly in response to fluctuations in world prices, partly in response to variations in foreign demand for particular grades, and partly in response to other influences less readily apparent.

Chart 3 (p. 190) is designed to show that futures prices provide an unsatisfactory picture of the movement of the general range of Winnipeg cash wheat prices. This chart shows the spreads between weekly average prices of No. 3 Northern and No. 1 Northern, No. 3 and the weighted average, and No. 3 and the active futures. Thus, as in Chart 2, prices of No. 3 Northern constitute the base from which deviations are measured. Futures prices are plotted in such a manner that both the closing future and the future next to close are shown in the closing month; but for convenience we have omitted November futures in such years as they were quoted, and have employed only the May, July, October, and December futures.

With many interesting features of the chart we are not here concerned—for example, the erratic behavior of the July future in May-June 1925; or the low position ordinarily taken by the October future in

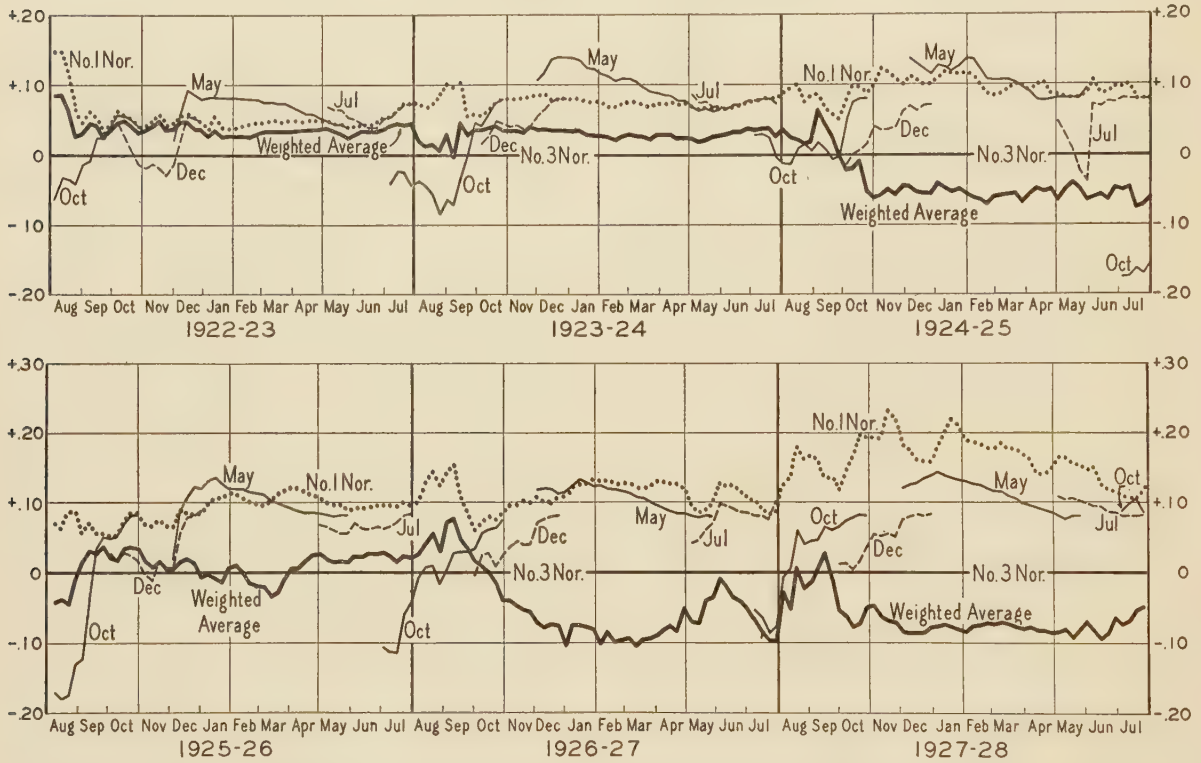
[1] Based on data in Table 1, p. 178, and on assumptions set forth on p. 181 respecting the detailed classification of no grade wheat.

July-September; or the fact that at some time in the closing months, the closing future has always sold at a level 8 cents or less above No. 3 Northern, never consistently higher.

therefore, a series of futures prices would misrepresent the general range of Winnipeg cash prices by showing it markedly too high in these months of most years. By comparison with the weighted average the

CHART 3.—RELATIONS BETWEEN FUTURES PRICES AND WEIGHTED AVERAGE CASH PRICES OF WHEAT AT WINNIPEG, IN TERMS OF DEVIATIONS FROM THE PRICES OF NO. 3 NORTHERN MANITOBA, WEEKLY, CROP YEARS 1922–23 TO 1927–28*

(Canadian cents per bushel)



* Based on cash prices in Appendix Table I and futures prices from the *Grain Trade News*.

For present purposes the chart serves merely to emphasize the fact that futures prices cannot be regarded as representative of the general range of cash wheat prices at Winnipeg even to the extent that prices of a single grade can be regarded as representative. With a few exceptions, prices of the active futures always run above the prices of No. 3 Northern; the principal exceptions are the prices of the October future during August–September. The May future during the mid-winter months ordinarily runs higher even than cash prices of No. 1 Northern, at least in years when supplies of No. 1 Northern are not distinctly short, as they were in 1927–28. On the whole, level shown by May futures was less than 10 cents too high in 1922–23, 1923–24, and part of 1925–26, but it was 15 cents or more, sometimes over 20 cents, too high in 1924–25, 1926–27, and 1927–28. If cash prices of No. 1 Northern misrepresent the range of Winnipeg cash prices, futures prices misrepresent it still more noticeably.

Obviously one could not by a simple mathematical process "splice" or link together the prices of the various futures in order to obtain a continuous series of any significance. For example, with the gaps between July and October futures prices in July usually exceeding 10 cents per bushel, to average July and October futures prices

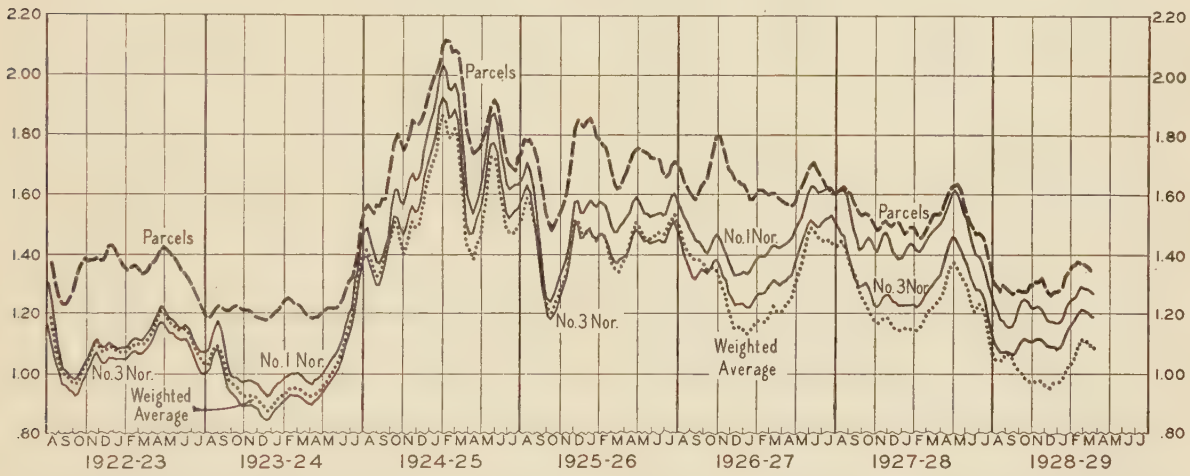
and to regard the result as showing the general course of Winnipeg cash prices would obviously be fallacious. The series would have no meaning. In each year except 1928 a sudden and extensive decline (in relation to actual cash prices) in the course of Winnipeg prices so determined would be made to appear in July–August, followed by a sudden rise in September–October. The linking operation would be less objectionable between October and December, December and May, and May and July futures in most years; but it would result in a price series unreal in every sense and quite undependable as a guide to changes in the general course and level of Winnipeg prices.

Chart 4 shows Winnipeg weekly weighted average prices in relation to prices of No. 1 Northern, No. 3 Northern, and British parcels prices. Here all series are presented in the form of three-week moving averages; the smoothed curves give a clearer picture of significant movements. The chart serves several purposes. Sometimes one desires to make broad comparisons of changes in the level and course of wheat prices in Canada and in the greatest wheat-importing country, the United Kingdom. Although it is not a weighted average series, the British parcels price series serves fairly well, in our judgment, to represent the weekly range of wheat prices in the United Kingdom—certainly that of imported wheat, and fairly closely that of all wheat used, since the United Kingdom imports nearly six times as much wheat as she produces. Broad comparisons between Canadian and United Kingdom prices are made more trustworthy and significant by the Winnipeg weighted average than by the use of the prices of a single grade of Canadian wheat. Further, the chart illustrates, in a manner different from Chart 2, certain erroneous conclusions which may be drawn if one employs the prices of any single grade of wheat as representative of the general range of Canadian terminal prices.

It is perhaps worth while again to emphasize some of these faulty inferences. The chart shows clearly that Winnipeg prices in the five years 1924–25 to 1928–29 are made to appear far higher by comparison with prices in 1922–23 and 1923–24 if one employs the prices of No. 1 Northern than if one employs the weighted average prices, and these obvious contrasts scarcely require further comment. But even between No. 3 prices and weighted average prices there are marked differences. Using the highest

CHART 4.—WEIGHTED AVERAGE CASH PRICES AT WINNIPEG IN COMPARISON WITH THE PRICES OF NO. 1 NORTHERN MANITOBA AND NO. 3 NORTHERN AT WINNIPEG, AND WITH BRITISH PARCELS PRICES, WEEKLY FROM AUGUST 1922*

(U. S. and Canadian dollars per bushel; 3-week moving averages)



* Canadian prices derived from data in Appendix Table I, expressed in Canadian dollars per bushel; British parcels prices are weekly average prices based upon all sales of wheat parcels in the United Kingdom, expressed in U.S. dollars per bushel.

weekly prices in December of each of the years for which prices are shown, one may reach such varying conclusions as the following. Between December 1923 and December 1924, Canadian prices rose 85 cents per bushel if No. 3 prices are the basis of comparison, but 76 cents per bushel if weighted average prices are the basis. Canadian prices declined 31 cents per bushel, No. 3 basis, between December 1925 and December 1926, but 39 cents as judged by the weighted averages. More striking still, December prices were 22 cents higher in 1928 than in 1923 as judged by No. 3 prices, but only 7 cents higher as judged by the weighted averages.

No elaborate analysis of the relationships between Canadian and British prices need be attempted here. One does not expect, of course, that the spread between Canadian and British average prices should remain constant. Transportation costs vary, and ordinarily Canadian wheat is relatively less important on the British market in February–April and July–September than in other months. Here we need only point out several inferences respecting Canadian-British wheat price relationships which look reasonable if one employs prices of No. 1 Northern as representative of the range of Canadian prices, but which appear unsound when the weighted average is used. One might, for example, be led to suppose that Canada was not in a position to export wheat to the United Kingdom during most weeks in early 1925 and most weeks after April 1927, unless transportation costs were extremely low; for spreads between the prices of No. 1 Northern and of British parcels usually fell below 10 cents in these periods. In July–August 1927, indeed, the use of No. 1 Northern prices as representative of the range of Winnipeg prices would lead to the faulty inference that Canadian prices in general were fully as high as British import prices. On the same assumption one might be led to the conclusion that Canadian prices tended upward from mid-December 1927 to mid-February 1928, at a time when British parcels prices were tending downward. A similar inference might be drawn with respect to the course of prices in October 1928. During this period the prices of both of No. 1 and No. 3 Northern moved upward while parcels prices remained stable; but the weighted average moved downward. On the whole, a far more consistent spread appears between parcels prices and weighted average prices than between parcels prices and No. 1 prices. Similarly the spread between parcels prices and Winnipeg weighted average prices is more consistent than that between parcels prices and No. 3 prices; striking anomalies are less often found when one uses No. 3 than when one uses No. 1. However, one might infer, in using No. 3 prices as representative, that Winnipeg wheat prices rose further between 1923–24 and 1924–25 in relation to United Kingdom prices than they did in fact; or that they fell relatively less between 1925–26 and 1926–27 and between 1927–28 and 1928–29, than they did in fact.

Further comparisons, and more elaborate analyses of the comparisons already presented, might be undertaken; but they are not germane to the present study. The foregoing pages perhaps serve to demonstrate that a weekly series of weighted average cash prices at Winnipeg has virtues for certain purposes, and also to suggest that our method of constructing the weighted averages leads to fairly significant results. We believe that this series provides a more satisfactory picture of week-to-week changes in the general level and course of both Winnipeg and Canadian cash wheat prices than is available from other price quotations, cash or futures. The series is least trustworthy during the months of transition from old to new crop; and it is subject to other qualifications. For comparisons in which errors of two or three cents are of vital importance, it is not satisfactory. But in broad comparisons of wheat price movements in various countries throughout the world, or in analyses of changes in the level of the broad range of Canadian prices, it seems both useful and significant.

This study is the work of M. K. Bennett, with the assistance of Janet Murray and P. S. King

APPENDIX

TABLE I.—AVERAGE CASH CLOSING PRICES OF 10 GRADES OF CANADIAN WHEAT AT WINNIPEG, AND WEIGHTED AVERAGES WEEKLY FROM AUGUST 1922*

(Cents per bushel)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	Tough No. 1	Tough No. 2	Tough No. 3	Weighted average
1922 Aug. 5[a]	130.9	121.3	116.2	101.0	90.2	81.7	71.7	115.7[b]	110.7[b]	106.5[b]	124.5
12[a]	124.9	115.9	110.2	97.0	84.0	78.4	69.4	110.2[b]	105.5[b]	101.0[b]	118.7
19	117.1	111.0	105.8	91.9	78.0	69.1	59.0	103.2	100.5	96.4	112.0
26	110.8	107.6	104.8	89.6	78.4	70.3	60.2	98.1	96.8	95.1	107.3
Sept. 2	103.2	101.5	98.8	88.3	79.9	70.5	60.5	93.8	91.6	89.1	101.8
9	103.5	101.1	97.4	88.3	81.6	72.7	63.0	94.2	91.7	88.4	101.9
16	97.8	97.5	92.6	86.5	80.7	71.0	61.0	86.9	87.7	84.5	96.6
23	100.6	100.1	97.6	91.1	85.0	75.9	65.9	95.5	93.8	90.4	99.9
30	97.5	95.9	92.9	89.5	83.1	73.6	62.9	93.9	92.3	89.1	96.5
Oct. 7	97.1	95.9	91.1	88.0	81.5	73.8	62.9[c]	93.2	92.3	88.0	95.8
14	98.9	98.1	93.2	90.8	85.8	77.8	66.6	96.1	94.5	90.1	98.1
21	101.7	100.8[c]	96.6	92.7	87.2	82.1	70.6	99.0	97.4	93.0	100.7
28	103.7	102.8	99.7	92.5	87.3	82.1[b]	70.6[b]	100.5	99.0	94.5	102.9
Nov. 4	105.4	104.2	101.2	94.4	89.4	83.3	73.3	102.0	100.9	96.8	104.6
11	106.3	104.8	101.5	95.4	90.7	84.4	74.4	103.0	102.0	98.0	105.5
18[c]	112.4	110.5	106.7	100.7	96.1	89.4	79.4	108.0	107.0	103.1	111.6
25[c]	112.4	110.5	108.2	101.7	97.7	90.8	81.1	108.5	107.5	103.5	111.7
Dec. 2	109.9	108.0	105.5	100.2	95.1	88.0	78.4	107.4	106.4	102.4	109.1
9	107.2	105.5	101.7	98.3	92.3	85.0	76.0	104.6	102.9	98.5	106.4
16	108.7	105.8	102.9	98.4	92.4	85.4	76.4	103.9	101.0	97.5	107.5
23	110.8	107.9	105.5	100.6	94.1	87.1	78.1	105.6	102.6	98.6	109.2
30	111.0	108.7	106.3	100.8	94.3	87.3	78.3	108.4	105.4	101.4	109.9
1923 Jan. 6	106.9	105.5	103.4	98.0	91.5	84.5	75.5	105.2	102.5	98.9	106.0
13	109.8	106.6	104.3	99.4	92.5	85.5[c]	76.5	106.1	103.6	99.9	107.7
20	109.4	107.8	105.7	100.8	93.8	86.8	77.8	107.3	104.8	101.3	108.1
27	107.9	106.3	104.1	99.1	92.1	85.1	76.1	105.6	103.1	99.6	106.7
Feb. 3	108.0	106.4	104.1	99.1	92.1	85.1	76.1	106.4	103.9	100.4	106.6
10	110.1	108.5	106.0	100.8	94.3	87.3	78.0	108.5	106.0	102.8	108.5
17	112.6	110.8	108.3	103.3	96.8	89.8	80.3	110.8	108.3	105.3	110.6
24	111.8	109.8	107.2	102.0	95.5	88.4	79.0	109.5	107.0	104.0	110.1
Mar. 3	110.8	108.8	106.2	100.6[c]	94.1	87.1	77.6	108.1	105.6	102.7	109.4
10	110.4	108.4	105.6	100.1	93.6	86.6	77.1	107.6	105.1	102.1	108.9
17	112.2	110.2	107.4	101.7	95.2	88.2	80.0	109.3	106.8	103.8	110.6
24	113.8	112.3	109.2	103.7	97.3	90.3	83.4	111.5	109.0	106.0	112.4
31	114.5	112.5	109.5	103.8	97.3	90.3	84.3	111.3	109.0	106.0	112.8
Apr. 7	116.6	114.7	111.8	105.9	99.6	92.6	86.9	112.9	111.0	108.0	115.3
14	121.1	119.4	116.3	111.4	107.5	100.4	94.4	117.0	115.5	112.5	119.8
21	122.0	120.2	117.0	111.2	108.7	102.7	96.7	117.9	116.4	113.4	120.6
28	122.2	120.3	117.3	113.0	108.6	102.6	96.5	118.1	116.5	113.5	120.9
May 5	119.7	117.6	114.8	110.4	105.7	99.6	94.5	115.2	114.2	111.2	118.7
12	117.3	115.3	112.8	108.4	103.8	97.8	92.3	112.8	111.8	109.3	116.2
19	117.3	115.3	112.8	108.5	104.3	98.3	93.3	112.8	111.8	109.3	115.8
26	118.1	116.7	114.2	109.6	105.1	99.1	94.1	113.6	112.6	110.1	116.6
June 2	113.3	112.3	109.3	104.7	100.2	94.2	89.1	108.8	107.8	105.3	112.2
9	115.1	114.2	110.9	106.3	102.3	96.3	90.3	110.2	109.2	106.7	114.3
16	117.2	116.2	113.1	108.0	105.5	99.5	92.0	112.0	111.0	108.5	116.3
23	115.7	114.0	111.0	105.9	103.4	97.4	89.9	109.9	108.9	106.0	114.2
30	112.5	110.5	107.3	103.5	99.9	93.9	86.5	107.5	105.9	102.9	110.9
July 7	111.9	110.4	106.4	102.2	96.9	90.9	82.1	106.9	105.4	101.9	110.5
14	108.2	106.7	101.9[c]	96.4	93.2	87.2	77.4	103.2	101.7	96.9	106.3
21	106.8	104.2	99.6	92.5	89.5	83.8	72.8	100.8	98.1	93.5	103.8
28	107.6	104.7	100.4	89.6	85.1	80.1	69.3	100.4	97.7	93.0	104.8

* Data from *Canadian Grain Statistics.*

[a] Averages of daily quotations in *Annual Report,* Winnipeg Grain Exchange.

[b] Interpolated.

[c] Averages of daily quotations in *Weekly Market News.*

TABLE I.—WINNIPEG PRICES—*Continued*

(*Cents per bushel*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	Tough No. 1	Tough No. 2	Tough No. 3	Weighted average
1923 Aug. 4	106.9	102.6	99.7[a]	90.8	84.3	77.8	66.8	100.4	96.9	93.1	101.6
11	108.0	102.5	101.2	90.6	83.4	76.4	65.4	101.6	97.6	95.6	102.3
18	111.5	107.3	104.4[a]	92.7	83.7	76.7	65.7	104.9	100.9	98.2	105.7
25	118.5	114.5	110.2	96.0	85.4	78.4	63.6	108.8	104.8	101.8	110.8
Sept. 1	117.5	112.5	107.5	96.0	83.5	72.5	61.1	106.0	101.0	99.0	110.3
8	116.3	110.5	106.8	95.3	83.7	72.7	62.5	105.0	99.3	97.3	106.4
15	109.3	103.9	99.1	90.6	79.6	69.1	61.5	95.3	90.6	88.6	103.6
22	101.1	98.2	95.7	88.9	80.2	70.9	64.7	88.6	87.6	86.7	98.4
29	97.9	95.9	92.1	86.9	80.2	71.2	65.9	87.6	86.6	83.3	95.7
Oct. 6	98.9	96.9	93.5	88.8	81.9	72.9	67.9	89.4	88.4	85.8	97.0
13	99.0	97.3	92.8	87.7	81.7	72.7	67.7	89.5	88.5	86.5	96.6
20	96.5	94.0	89.0	82.5	77.1	69.6	65.3	87.4	86.4	82.6	93.1
27	96.7	94.0	88.7	82.1	76.1	69.1	66.2	87.3	86.7	82.7	92.1
Nov. 3	97.8	94.8	89.8	83.1	77.1	70.1	68.3	88.6	87.6	83.6	93.0
10	97.4	94.4	89.4	82.6	76.6	71.4	69.2	88.4	87.4	83.9	92.7
17	97.4	94.3	89.3	82.9	76.8	73.2	70.4	88.3	87.3	84.3	92.3
24	97.8	94.6	89.5	82.6	76.0	73.1	71.3	88.5	87.5	84.5	93.3
Dec. 1	95.6	92.6	87.1	79.0	71.9	69.4	68.1	87.0	86.0	82.2	90.6
8	95.7	92.6	87.0	79.9	71.5	69.6	67.6	87.8	86.8	81.3	90.6
15	92.4	89.4	84.5	77.6	69.6	67.5	65.5	85.4	84.4	78.9	87.9
22	92.1	89.1	84.1	77.3	69.1	67.1	65.1	85.1	84.1	78.9	87.4
29	92.3	89.3	84.3	77.2	69.2	67.2	65.2	86.2	84.2	79.2	87.5
1924 Jan. 5	94.2	91.2	86.2	79.9	71.9	69.7	67.5	88.3	86.3	81.3	89.4
12	96.6	93.6	88.6	83.6	75.8	73.4	70.9	91.1	89.1	84.1	91.9
19	96.9	93.9	89.3	84.1	76.9	73.8	70.8	91.8	89.8	85.2	92.1
26	96.9	93.8	89.2	84.1	76.9	73.4	70.4	91.8	89.8	85.3	91.8
Feb. 2	98.3	95.2	91.0	86.2	78.9	75.1	72.1	93.1	91.1	86.6	93.7
9	99.9	96.9	93.0	88.7	82.1	77.2	73.1	95.2	93.2	88.7	95.4
16	99.4	96.4	92.6	88.3	82.4	78.6	71.9	94.7	92.7	88.6	94.6
23	99.9	96.9	92.7	88.3	82.3	76.5	71.5	95.0	93.0	89.0	95.2
Mar. 1	99.9	96.9	92.3	87.7	81.9	76.1	71.1	94.6	92.6	88.6	95.1
8	100.0	97.0	92.5	87.8	81.8	75.9	70.9	94.4	92.4	88.4	95.0
15	97.9	94.9	90.8	86.1	79.9	73.9	68.9	92.5	90.5	86.5	93.3
22	98.1	95.1	91.2	86.7	80.7	75.2	71.2	92.7	90.7	86.7	93.2
29	96.1	93.1	88.9	84.5	78.3	73.6	69.6	90.5	88.5	84.5	91.6
Apr. 5	96.6	93.7	89.5	85.0	78.6	74.6	70.6	92.1	90.1	86.1	92.3
12	97.9	94.7	90.4	86.4	79.2	75.1	71.1	93.1	91.1	87.1	93.2
19	98.9	95.8	91.8	87.7	80.7	76.5	72.3	94.3	92.3	88.3	93.9
26	99.1	96.1	91.8	86.9	81.4	76.3	72.3	94.4	92.4	88.2	94.0
May 3	101.0	97.9	94.2	89.7	83.8	77.7	73.0	96.0	94.0	90.9	96.3
10	102.8	99.5	96.3	91.3	85.8	79.0	73.0	97.5	95.5	93.1	98.0
17	103.0	99.7	96.3	91.2	85.7	79.2	72.7	97.7	95.7	93.2	98.3
24	105.6	102.1	99.1	94.0	88.2	81.7	74.3	100.0	98.2	96.1	101.4
31	106.9	103.6	100.3	95.5	90.2	83.5	77.0	101.9	99.9	98.0	102.9
June 7	106.8	102.9	100.2	95.2	91.0	84.4	76.0	101.7	99.7	97.3	103.1
14	110.5	106.7	103.6	98.6	93.9	88.3	77.9	105.7	103.7	100.6	106.7
21	117.5	113.9	110.5	104.0	98.1	92.6	81.6	112.6	110.6	107.4	113.6
28	119.1	115.9	111.5	103.9	98.4	92.9	82.4	113.7	111.7	108.1	115.2
July 5	122.9	119.9	115.2	108.5	102.4	96.8	84.0	117.0	115.0	111.9	118.7
12	123.3	120.3	115.3	109.7	102.1	94.7	81.1	117.2	115.2	112.2	118.9
19	136.0	133.0	128.0	122.8	113.8	103.5	92.3	129.3	127.3	124.3	131.7
26	144.0	140.3	136.0	128.0	119.3	108.5	97.5	134.5	132.5	130.0	138.5

[a] Averages of daily quotations in *Weekly Market News*.

TABLE I.—WINNIPEG PRICES—*Continued*

(*Cents per bushel*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	Tough No. 1	Tough No. 2	Tough No. 3	Weighted average
1924 Aug. 2	150.8	145.1	141.9	134.0	125.5	113.6	104.3	140.5	137.6	136.1	145.3
9	148.5	141.1	139.1	131.6	122.9	110.9	99.9	137.9	134.9	133.9	141.3
16	146.7	139.6	136.7	129.3	121.7	109.4	99.2	137.5	133.6	131.7	138.7
23	140.2	135.3	132.8	124.3	114.5	103.2	94.5	131.5	127.9	125.9	134.1
30	136.6	131.6	128.2	119.7	109.1	98.9	90.4	126.4	122.4	120.4	129.9
Sept. 6	136.0	131.5	127.5	121.0	109.2	100.8	92.9	127.6	123.9	121.7	133.6
13	138.7	135.1	132.1	124.7	113.9	107.2	101.0	132.5	128.5	125.9	136.3
20	142.9	139.9	137.1	129.1	119.1	111.1	105.6	136.3	133.2	130.4	139.6
27	146.6	143.5	141.5	133.7	123.7	116.5	108.5	141.3	138.9	136.8	141.1
Oct. 4	156.6	153.0	148.9	138.6	128.3	120.3	113.6	151.6	149.0	144.9	146.7
11	164.2	159.1	154.3	143.8	131.8	119.2	109.0	159.2	155.3	150.0	152.2
18	163.3	158.9	153.6	143.1	130.9	118.9	106.6	158.6	154.0	149.0	152.6
25	156.8	153.0	148.0	136.4	122.1	111.0	96.1	152.6	148.6	143.1	142.6
Nov. 1	153.0	148.3	143.3	134.0	118.2	106.3	96.0	148.5	144.4	138.9	137.2
8	159.7	153.3	147.6	136.3	120.5	107.4	96.9	152.8	148.3	142.8	141.9
15	168.4	162.5	156.7	146.3	133.6	119.7	104.3	162.7	158.3	152.7	151.7
22	166.3	161.1	155.6	144.6	134.2	119.0	99.0	161.6	156.8	151.5	149.9
29	165.3	160.7	155.3	145.5	137.6	122.3	101.2	161.3	156.5[a]	151.4	150.7
Dec. 6	162.3	156.8	151.3	141.0	133.7	119.9	98.3	157.8	152.8	147.3	146.5
13	167.9	162.0	157.5	146.9	137.3	123.3	103.0	163.4	157.6	152.6	152.2
20	175.0	169.8	165.0	155.5	146.1	133.0	111.4	169.9	165.4	161.1	159.3
27	182.2	177.1	172.1	162.0	153.2	141.6	120.9	177.1	171.5[a]	168.1	166.5
1925 Jan. 3	184.0	178.1	173.1	165.3	154.7	143.1	123.1	178.8	173.6	168.9	169.0
10	186.7	179.8	174.8	165.8	158.3	147.2	127.5	181.1	175.3	170.9	170.0
17	193.0	186.3	181.3	170.2	164.0	152.1	133.5	187.0	181.4	176.9	176.0
24	197.4	191.5	185.9	174.9	168.9	156.7	138.5	191.9	186.5	181.7	180.9
31	211.6	205.9	200.1	189.2	183.1	170.4	149.1	206.4	200.9	195.4	194.4
Feb. 7	200.6	194.6	189.4	178.2	172.2	159.0	133.3	195.6	189.6	184.4	183.3
14	191.9	186.1	182.0	171.6	165.0	153.9	129.0	186.9	181.1	177.0	175.4
21	194.1	188.9	185.4	175.0	168.1	158.1	134.1	189.5	184.3	180.8	178.4
28	199.2	194.4	190.9	180.0	172.4	162.4	139.4	194.1	189.4	185.8	184.9
Mar. 7	197.6	193.1	188.9	179.0	170.3	159.4	134.9	189.1	184.6	180.4	183.1
14	184.4	179.3	175.0	165.3	156.3	144.6	119.6	175.4	170.3	166.0	169.3
21	165.8	160.2	155.8	147.3	136.0	126.2	103.0	155.9	150.4	145.9	150.2
28	166.7	161.5	157.0	148.6	133.0	123.0	102.0	154.7	149.5	145.0	150.1
Apr. 4	145.6	141.2	136.6	127.4	113.8	103.8	82.5	133.6	129.2	124.6	130.9
11	156.5	150.9	146.5	137.8	121.3	110.7	89.4	144.5	138.9	134.5	141.6
18	159.0	153.4	148.9[a]	139.0	121.6	110.6	90.6	147.3	141.8	137.3	143.7
25	158.9	155.1	150.3	140.3	124.6	111.2	91.2	148.9	145.1	140.2	145.3
May 2	161.9	158.4	153.4	140.5	124.5	109.3	92.0	148.8	145.4	140.4	146.7
9	176.4	173.3	168.3	153.7	138.6	117.2	103.4[a]	163.9	160.9	155.9	163.3
16	178.0	175.0	170.0	155.3	139.7	119.8	108.4	166.2	163.2	158.2	165.9
23	187.6	184.6	179.6[a]	160.3	140.2	121.7	111.3	172.1	169.1	163.1	174.7
30	192.6	189.0	183.8	161.6	141.8	123.0[a]	116.2	174.6	171.0	165.0	177.4
June 6	180.8[a]	175.5	170.4	159.3	135.7	115.0[a]	99.1	167.9	165.1	157.4	164.3
13	177.3	173.8	168.8	157.8	135.6	112.5	93.1	164.9	163.8	156.1	163.1
20	165.9	162.3	156.9	145.6	124.2	105.1	84.6	154.5	152.4[a]	145.1	150.4
27	166.0	161.6	156.3	146.8	124.0	107.7	88.7	155.2	151.6	145.9	151.4
July 4	158.9	154.7	149.4	141.6	117.6	100.0[b]	81.0[b]	148.6	144.6	139.4	144.4
11	160.9	156.5	150.9	144.0	118.1	101.2	82.0[b]	148.1	146.4	140.8	146.2
18	166.8	163.6	158.7	150.9	123.7	108.0	92.7	154.0[b]	151.0[b]	146.0[b]	151.1
25	161.9	159.3	154.0	145.1	118.3	102.6	87.0[b]	150.0[b]	147.0[b]	142.0[b]	146.9

[a] Average of daily prices given in *Grain Trade News*.
[b] Interpolated.

TABLE I.—WINNIPEG PRICES—*Continued*

(Cents per bushel)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	Tough No. 1	Tough No. 2	Tough No. 3	Weighted average
1925 Aug. 1	160.9	158.6	152.9	143.3	120.2	102.7	87.9	146.3	143.8	138.3	146.8
8	171.2	170.0	164.3	154.7	132.5	111.9	96.9	158.8	157.4	151.6	160.0
15	168.9	164.9	162.9	154.9	131.4	111.0[a]	95.0[a]	155.8	152.9	150.3	159.0
22	170.7	165.7	162.3	154.4	131.2	109.0[a]	91.0[a]	158.2	153.7	150.3	157.7
29	163.2	158.9	154.7	146.4	125.2	101.2	81.2	151.2	146.9	142.7	153.9
Sept. 5	152.1	150.0	146.6	139.1	118.1	100.8	80.8	139.5	137.6	134.2	147.9
12	145.2	141.2	138.4	128.6	115.0	98.7	76.7	132.8	128.4	126.4	141.4
19	135.6	132.6	130.2	122.7	112.7	99.2	79.0	125.0	121.8	119.7	132.8
26	128.4	126.3[b]	123.1	117.6	107.4	97.4	78.2	118.4	116.3	113.1	126.5
Oct. 3	120.9	118.2	116.1	110.3	100.9	92.2	72.5	114.4	111.6	109.5	118.1
10	124.0	121.1	118.9	110.9	103.9	95.3	75.9	118.8	115.8	113.7	120.5
17	126.2	123.1	119.0	111.7	99.5	87.4	76.0	121.2	118.0	113.9	122.2
24	128.3	125.1	119.9	112.3	97.9	83.8	73.1	122.8	119.6	114.5	123.3
31	133.5	130.2	125.3	119.7	107.9	88.9	78.6	125.9	123.2	118.2	128.5
Nov. 7	136.1	132.6	129.4	123.1	113.1	89.9	79.9	129.3	127.1	123.8	130.7
14	137.0	133.4	130.5	124.2	114.0	91.2	81.2	129.1	126.6	124.7	131.0
21	141.9	138.4	134.7	129.2	117.1	98.7	89.2	134.9	132.1	129.1	136.1
28	151.3	147.8	144.8	137.4	123.9	107.8	97.8	144.1	140.4	137.4	145.2
Dec. 5	161.5	157.3	155.2	150.1	134.7	115.7	100.8	156.2	152.0	149.1	155.6
12	159.4	155.1	150.6	143.8	133.7	118.8	102.0[a]	153.8	147.0	143.0	151.9
19	152.1	148.8	143.8	136.3	128.0	108.4	88.4	146.5	140.8	136.8	145.6
26	149.6	146.5	141.5	132.9	125.2	106.2	86.2	142.7	138.2	134.2	142.7
1926 Jan. 2	159.9	156.5	151.5	143.0	135.8	116.8	96.8	153.5	148.8	144.5	150.8
9	158.7	154.0	149.0	141.3	134.3	115.4	95.4	152.3	148.2	143.2	148.7
16	155.2	149.7	144.7	137.1	130.1	111.1	91.1	147.7	143.7	138.7	143.8
23	155.5	149.9	144.9	137.3	129.6	110.6	90.6	146.5	142.1	137.1	143.5
30	156.6	150.5	145.5	138.4	129.8	110.9	90.9	148.3	143.5	138.5	146.1
Feb. 6	159.9	154.0	148.9	141.8	132.8	114.3	94.3	151.8	146.7	141.7	149.9
13	154.7	149.1	144.1	136.9	127.9	109.4	89.4	146.9	141.4	136.3	144.2
20	153.3	148.0	143.3	135.8	126.7	108.2	88.2	145.7	140.2	134.8	142.0
27	150.9	145.9	141.1	133.5	124.3	106.1	86.1	143.3	138.1	132.9	139.2
Mar. 6	144.1	139.5	134.6	127.1	117.9	102.6	82.6	136.7	131.6	126.4	132.5
13	147.5	142.4	137.3	129.5	120.6	108.1	88.1	139.1	133.3	128.8	133.9
20	150.6	144.8	139.5	132.4	122.9	111.4	91.4	141.6	135.4	131.4	136.5
27	149.6	143.1	138.1	130.6	121.1	109.6	89.6	140.6	133.8	129.8	137.3
Apr. 3	151.2	144.2	139.2	131.7	121.9	110.3	92.5	142.0	135.1	130.7	139.8
10	153.2	146.3	141.3	134.5	124.3	112.0	97.8	144.5	138.0	133.2	141.8
17	157.4	151.2	146.2	140.1	129.7	116.7	102.7	149.3	144.7	139.7	147.8
24	160.9	155.0	150.0	144.1	133.4	120.4	103.9	152.9	149.4	144.5	152.3
May 1	158.6	153.1	148.0	142.0	131.2	118.2	101.2	150.7	147.1	142.4	150.6
8	154.3	149.5	144.5	138.0	125.5	112.5	96.2	145.6	142.8	138.1	146.2
15	154.3	149.9	144.8	137.8	124.9	111.0	95.8	145.0	143.0	138.3	146.1
22	152.9	148.6	143.5	135.2	121.7	107.2	92.7	142.9	140.6	136.6	144.9
29	153.7	150.0	145.0	136.0	123.5	105.6	92.7	143.3	141.2	138.0	146.2
June 5	150.7	146.6	141.6	134.0	122.7	105.1	89.1	141.2	139.3	136.1	143.8
12	154.7	150.6	145.6	137.9	127.2	110.9	90.7	145.3	143.8	140.8	147.6
19	154.8	150.6	145.6	137.9	127.9	112.1	91.3	148.1	145.3	142.2	148.2
26	152.3	148.0	142.9	135.8	126.2	111.2	89.2	147.1	143.0	139.2	145.4
July 3	152.4	147.5	142.8	135.8	125.8	110.4	88.9	147.2	142.8	139.6	145.5
10	155.8	150.6	146.4	137.8	126.8	110.3	91.3	146.2	143.8	140.0	148.5
17	162.0	157.5	152.8	143.8	132.1	115.1	95.5	151.5	150.0	146.0	154.2
24	159.7	155.2	149.7	141.0	129.6	113.6	93.6	148.4	147.7	143.7	151.9
31	159.9	155.6	150.5	141.8	129.5	112.9	92.9	149.2	148.5	145.1	152.5

[a] Interpolated.

[b] Averages of daily quotations given in *Grain Trade News.*

TABLE I.—WINNIPEG PRICES—*Continued*

(*Cents per bushel*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	Tough No. 1	Tough No. 2	Tough No. 3	Weighted average
1926 Aug. 7	153.4	149.4	143.3	133.6	122.2	104.6	84.6	143.0	142.0	136.3	145.7
14	152.6	148.6	139.8	131.3	119.4	102.4	82.4	141.6	140.6	132.6	143.8
21	151.3	146.6	137.2	129.1	116.3	99.3	79.3	139.9	138.9	131.8	142.6
28	148.9	143.4	136.6	125.9	112.9	95.9	79.9	133.2	132.2	129.9	139.5
Sept. 4	145.1	139.7	130.9	120.2	109.1	92.1	76.2	128.8	128.2	125.6	137.9
11	145.1	136.7	130.1	117.5	107.1	90.7	75.7	125.6	124.7	123.3	137.7
18	143.9	138.1	133.4	120.3	110.3	94.3	79.3	127.2	126.6	124.9	138.1
25	143.3	139.2	134.9	123.2	111.9	95.9	80.9	129.8	128.8	126.4	138.2
Oct. 2	142.1	139.2	136.1	126.3	113.3	97.3	82.3	131.2	130.1	128.2	137.7
9	138.9	134.8	131.8	123.8	111.3	95.3	80.3	131.2	129.2	125.2	132.7
16	140.5	136.5	132.7	125.2	112.7	97.9	82.9	132.9	129.5	125.1	132.8
23	148.3	144.5	141.0	133.6	120.1	108.1	93.1	140.1	136.3	132.2	139.7
30	146.7	142.8	138.3	131.5	118.7	106.7	91.7	137.4	133.9	129.7	134.3
Nov. 6	144.7	140.0	135.2	127.0	116.3	104.3	90.1	135.7	131.6	127.2	131.2
13	144.1	139.5	134.5	124.9	114.8	102.1	87.5	135.7	131.1	126.3	129.6
20	139.3	134.2	129.2	119.7	108.6	94.8	80.7	130.8	125.7	120.4	123.7
27	138.6	133.7	128.7	119.2	107.9	93.5	79.2	131.5	125.5	119.4	122.9
Dec. 4	134.3	130.0	123.6	112.8	100.5	83.4	70.9	128.8	122.2	115.4	116.4
11	132.9	128.9	122.9	112.5	100.2	83.0	71.5	128.2	121.7	114.7	115.0
18	131.5	127.5	121.5	111.9	100.3	84.5	74.8	127.1	120.6	113.6	114.0
25	135.1	130.5	124.4	115.6	103.5	88.1	79.1	130.5	123.3	116.3	116.8
1927 Jan. 1	133.9	129.2	123.1	114.4	102.3	86.3	77.3	128.9	122.4	115.4	112.7
8	133.4	128.7	121.3	114.5	102.3	86.5	79.0	128.1	122.3	115.3	113.7
15	133.7	128.8	121.3	113.0	101.9	87.8	81.4	128.9	122.9	115.7	113.7
22	135.8	130.9	123.0	114.5	102.5	88.5	82.5	130.8	125.2	117.6	115.1
29	139.4	134.8	126.3	117.5	102.9	88.9	82.9	134.4	128.3	120.6	118.1
Feb. 5	139.6	135.2	126.7	118.2	103.0	89.5	83.0	134.5	128.2	120.7	116.5
12	139.4	134.9	126.4	117.8	102.9	89.9	82.9	133.7	128.2	120.7	117.8
19	139.3	134.9	126.7	116.6	102.8	90.3	83.3	133.3	127.3	120.3	116.8
26	140.0	135.3	127.4	116.8	102.8	90.8	83.3	134.1	128.0	121.2	117.7
Mar. 5	143.4	137.8	130.7	119.9	104.5	92.5	79.4	136.7	129.9	123.4	121.3
12	144.3	138.6	132.2	120.9	105.1	93.1	78.3	136.9	131.1	124.3	121.9
19	141.7	136.9	129.8	119.0	105.7	94.8	78.7	134.7	129.1	122.0	120.1
26	140.9	136.4	128.7	118.2	104.7	94.7	77.7	133.2	128.2	120.8	119.2
Apr. 2	143.6	138.5	130.7	120.5	106.3	96.2	79.1	135.0	130.2	122.7	121.7
9	144.3	139.9	131.5	121.6	107.3	96.6	80.1	136.1	132.2	124.0	123.2
16	143.5	139.9	130.9	120.6	106.6	94.9	81.2	135.6	131.5	123.0	123.1
23	145.9	142.4	133.3	122.4	109.4	96.7	85.4	136.4	132.8	124.2	124.8
30	146.9	143.0	135.1	124.0	113.4	101.4	89.4	137.7	133.5	125.6	129.7
May 7	152.2	148.4	142.6	130.1	120.3	108.3	96.3	143.0	138.0	131.4	135.5
14	152.6	149.4	144.1	131.4	123.2	110.3	98.7	143.7	137.5	133.8	136.8
21	153.2	149.7	144.2	132.7	124.6	113.7	98.5	144.4	138.4	134.5	140.1
28	162.9	159.4	153.0	141.5	133.3	124.1	107.5	153.2	147.5	143.6	149.3
June 4	164.2	160.2	151.7	142.5	135.4	126.4	107.2	153.9	149.7	144.7	150.8
11	160.9	156.6	148.7	139.7	128.8	122.0	102.3	149.8	146.1	141.1	146.7
18	162.1	157.6	149.9	140.7	129.8	119.2	104.0	150.3	147.3	142.6	146.2
25	160.3	156.0	148.7	138.8	129.3	113.3	104.3	149.2	145.5	141.5	144.5
July 2	160.0	156.0	149.4	139.5	129.9	111.0	104.7	150.5	146.0	142.7	144.1
9	162.9	158.1	152.8	141.6	131.3	112.8	106.1	152.8	148.4	145.5	145.9
16	162.0	157.9	152.9	138.2	122.7	104.7	97.7	150.2	147.6	144.7	144.3
23	162.3	159.2	154.2	139.2	121.4	103.9	96.9	147.1	146.8	142.7	144.4
30	161.2	158.2	152.5	138.7	121.4	105.1	97.8	148.3	147.4	140.7	142.7

TABLE I.—WINNIPEG PRICES—*Continued*

(*Cents per bushel*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	Tough No. 1	Tough No. 2	Tough No. 3	Weighted average
1927 Aug. 6	157.5	153.1	145.1	136.7	120.3	105.7	96.7	149.5	148.3	139.9	142.2
13	163.9	158.7	150.4	141.9	122.4	111.0	102.0	154.2	152.7	144.6	145.1
20	162.6	157.6	144.7	139.3	122.6	110.6	101.6	150.8	150.6	140.8	145.1
27	158.6	153.6	142.5	136.6	119.1	107.1	98.1	147.4	146.4	139.3	140.3
Sept. 3	153.7	147.3	136.9	131.7	115.5	103.5	94.8	140.3	137.2	133.7	135.5
10	150.4	144.6	134.6	128.2	115.2	101.0	94.0	136.6	135.4	131.6	135.0
17	141.7	139.6	128.2	118.9	110.5	94.6	86.2	130.7	129.6	124.9	130.9
24	142.7	139.2	129.1	122.9	113.9	97.0	86.2	131.2	129.5	124.3	128.1
Oct. 1	140.9	137.4	129.1	121.3	111.9	94.9	84.7	129.3	127.9	122.6	123.7
8	144.0	137.4	129.6	121.6	109.6	92.8	82.8	131.4	129.9	122.4	123.2
15	147.3	140.4	130.7	120.1	108.1	91.6	81.4	134.4	132.8	122.8	122.9
22	145.4	137.9	125.8	114.2	103.5	91.6	80.8	134.4	130.7	118.4	118.6
29	141.2	133.9	122.0	110.1	100.4	90.8	80.8	132.3	126.7	116.4	116.9
Nov. 5	140.4	131.7	121.1	109.2	99.6	91.9	81.9	134.6	127.4	117.2	116.3
12	141.5	135.0	122.5	110.7	98.8	91.4	82.5	136.9	131.8	118.6	116.1
19	148.8	141.1	125.6	113.8	100.6	93.8	83.6	142.6	138.0	120.1	118.6
26	149.6	143.7	127.8	115.7	101.9	94.6	87.8	143.6	140.9	123.3	120.6
Dec. 3	143.5	139.2	125.0	112.5	98.8	91.7	86.2	136.5	134.5	118.8	116.4
10	142.2	136.8	124.8	112.4	98.1	89.9	84.4	135.7	129.2	119.0	116.0
17	138.9	134.4	122.8	110.3	96.2	88.8	81.9	132.8	130.2	118.1	114.1
24	138.4	133.4	122.5	110.4	96.4	88.4	81.5	132.4	129.5	118.3	113.8
31	138.1	133.6	122.3	110.9	97.0	88.7	81.3	132.3	129.7	117.5	114.4
1928 Jan. 7	140.6	136.2	122.7	112.2	98.7	89.8	82.2	134.6	132.6	118.0	115.0
14	142.1	136.6	122.1	111.6	98.4	89.4	81.8	136.0	133.0	116.7	114.5
21	144.9	138.0	123.1	112.4	99.0	89.9	82.5	137.4	134.5	117.5	115.3
28	143.6	136.6	122.7	110.9	98.6	89.3	81.7	136.4	133.4	116.7	114.5
Feb. 4	141.1	135.1	122.2	110.1	98.1	88.8	81.1	135.1	132.1	116.5	113.8
11	140.1	134.4	121.6	109.5	97.1	87.8	80.1	134.1	131.4	116.2	113.9
18	141.7	136.6	123.5	111.9	99.0	90.0	82.4	135.7	133.2	118.6	115.8
25	144.2	139.4	126.4	114.7	102.0	93.0	85.9	138.2	136.1	121.6	119.2
Mar. 3	145.3	140.2	127.6	116.7	104.0	94.6	89.1	139.0	136.9	122.7	120.1
10	147.4	141.9	129.1	119.4	107.0	98.2	91.8	141.3	138.6	124.2	121.9
17	148.0	142.7	130.3	120.9	108.4	100.1	94.7	142.0	139.4	125.0	122.8
24	148.9	143.6	131.5	122.3	110.6	103.7	97.7	142.9	140.4	125.9	123.6
31	149.6	144.3	132.6	122.8	111.5	104.3	97.7	143.6	141.0	126.4	124.5
Apr. 7	151.0	145.7	134.9	124.8	113.4	105.7	100.4	145.0	142.2	128.7	127.0
14	154.5	150.0	140.3	130.9	119.0	110.5	105.6	148.5	145.7	134.1	131.9
21	158.0	153.7	144.1	134.3	121.9	113.4	106.8	152.0	149.0	137.8	135.7
28	160.0	155.1	145.3	135.7	123.4	114.2	107.4	152.7	149.7	139.4	136.6
May 5	162.9	156.9	146.7	137.6	125.5	115.7	108.7	154.0	151.3	141.0	138.1
12	161.2	154.7	144.7	135.8	123.9	114.3	107.5	152.7	149.4	138.9	136.4
19	155.2	148.2	139.6	131.1	119.7	110.0	103.6	147.7	143.2	133.7	130.3
26	155.9	149.4	140.7	133.6	121.9	112.0	105.4	148.4	144.4	134.9	132.6
June 2	150.1	143.8	135.5	129.2	117.4	107.2	100.8	140.5	136.4	129.5	128.5
9	148.1	141.5	133.2	126.9	115.3	104.4	96.7	138.1	133.4	126.8	125.0
16	141.8	136.8	129.2	122.2	111.5	100.9	93.6	131.8	129.8	122.7	119.8
23	139.2	134.9	127.6	120.7	111.1	99.6	92.9	129.2	128.1	121.5	118.8
30	139.3	134.9	127.9	121.0	111.9	100.1	93.2	129.2	128.3	121.6	121.3
July 7	140.1	136.1	129.1	122.1	113.1	101.9	94.1	130.0	129.1	122.6	121.7
14	134.8	131.1	124.3	117.2	107.9	98.0	89.3	124.8	123.9	118.2	117.3
21	128.6	126.3	118.2	112.6	103.5	93.6	84.1	118.9	118.6	113.1	112.7
28	124.0	122.3	112.3	107.7	98.6	89.7	80.5	114.2	113.7	107.2	107.3

TABLE I.—WINNIPEG PRICES—*Concluded*

(*Cents per bushel*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	Tough No. 1	Tough No. 2	Tough No. 3	Weighted average
1928 Aug. 4	124.7	121.6	111.5	107.2	97.9	90.7	81.4	114.7	112.9	105.6	106.6
11	119.8	117.1	107.3	103.2	94.4	88.3	78.7	109.8	108.8	101.5	103.3
18	118.8	116.0	107.4	103.6	95.6	90.0	81.8	109.3	108.3	102.8	103.9
25	116.1	113.1	105.9	101.9	94.2	87.6	80.2	107.9	105.5	101.7	105.2
Sept. 1	116.9	114.1	107.8	103.6	96.6	89.1	82.1	109.1	105.1	103.1	107.1
8	115.0	112.7	106.7	102.2	95.5	87.5	80.5	107.7	105.5	101.9	106.5[a]
15	114.3	109.9	104.8	99.1	91.0	83.1	76.1	107.6	104.1	100.3	105.8
22	117.6	112.5	106.3	100.5	92.2	84.2	77.5	109.8	105.9	101.9	103.1
29	120.9	114.0	107.9	99.9	90.9	85.0	75.7	112.7	109.7	104.4	99.9
Oct. 6	124.8	118.6	111.5	103.8	93.9	85.9	78.3	117.3	115.7	108.8	100.7
13	125.3	118.7	112.2	103.3	92.2	80.2	74.3	118.1	115.7	109.2	99.5
20	123.8	116.3	110.8	101.8	91.4	80.3	74.8	116.8	113.3	107.8	97.6
27	122.4	114.8	109.7	101.1	89.4	78.4	73.5	115.7	111.8	106.9	96.7
Nov. 3	121.4	116.2	111.2	103.4	90.2	79.1	74.9	116.4	113.2	108.7	97.8
10	121.2	115.5	110.5	103.9	90.0	78.2	74.3	115.5	112.5	108.0	96.9
17	123.5	117.0	112.2	107.1	93.8	80.7	75.0	116.9	114.0	109.7	98.6
24	120.6	116.3	111.7	105.8	94.5	78.8	72.1	115.4	113.3	109.0	97.9
Dec. 1	118.0	114.0	109.4	102.9	91.5	75.2	69.1	113.0	111.0	106.7	95.4
8	116.9	113.4	108.6	101.5	88.7	73.3	68.4	112.4	110.4	105.9	94.3
15	117.4	113.9	108.9	102.1	90.5	74.6	69.6	112.9	110.9	106.4	95.6
22	117.0	113.5	108.7	102.6	91.6	75.8	70.6	112.5	110.5	106.4	97.1
29	117.3	113.4	108.7	102.5	91.7	76.9	70.0	112.4	110.2	106.4	97.8
1929 Jan. 5	115.6	111.5	107.3	101.2	90.3	76.0	67.9	110.6	108.5	105.0	96.2
12	118.0	113.8	109.7	104.2	93.9	79.8	71.5	113.5	110.8	107.8	98.1
19	121.4	116.9	112.6	107.5	96.6	82.1	73.8	116.4	113.9	110.6	100.7
26	124.9	120.7	116.2	111.2	100.1	84.9	75.9	119.9	117.4	114.2	103.6
Feb. 2	124.7	120.9	116.4	111.7	100.5	86.1	75.7	119.7	117.8	114.5	102.5
9	124.8[b]	121.4	116.8	112.3	101.0	86.5	76.7	120.0	118.4	114.8	105.3
16	128.5	125.2	120.4	116.1	104.1	89.3	80.1	124.3	122.3	111.8	110.2
23	130.7	127.4	122.7	118.2	105.6	90.8	81.2	126.2	124.1	121.1	111.1
Mar. 2	128.3	125.3	120.5	115.8	103.9	88.8	78.9	123.7	121.7	118.7	110.9
9	126.8	123.7	119.2	113.7	102.7	88.0	77.9	122.4	120.5	116.7	108.7
16	129.3	125.8	121.3	115.4	105.0	90.0	80.3	125.8	122.8	118.8	111.2
23	126.5	123.1	118.7	112.8	102.4	87.3	77.5	123.4	120.4	116.5	107.9
30	124.1	120.8	116.4	110.7	101.1	85.6	75.1	121.6	117.8	114.3	105.5

[a] Interpolated.

[b] Averages of daily quotations in *Weekly Market News*.

TABLE II.—INSPECTIONS OF WHEAT AT WINNIPEG, BY GRADES, WEEKLY FROM AUGUST 1922*

(*Cars*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	No grade	Total	Other	Grand total
1922 Aug. 4	....[a]	....[a]	....[a]	...[a]	..[a]	..[a]	..[a]	....[a]	....[a]	...[a]	....[a]
11	....[a]	....[a]	....[a]	...[a]	..[a]	..[a]	..[a]	....[a]	....[a]	...[a]	....[a]
18	....[a]	....[a]	....[a]	...[a]	..[a]	..[a]	..[a]	....[a]	....[a]	...[a]	....[a]
25	....[a]	....[a]	....[a]	...[a]	..[a]	..[a]	..[a]	....[a]	....[a]	...[a]	....[a]
Sept. 1	....[a]	....[a]	....[a]	...[a]	..[a]	..[a]	..[a]	....[a]	....[a]	...[a]	....[a]
8	....[a]	....[a]	....[a]	...[a]	..[a]	..[a]	..[a]	....[a]	....[a]	...[a]	....[a]
15	....[a]	....[a]	....[a]	...[a]	..[a]	..[a]	..[a]	....[a]	....[a]	...[a]	....[a]
22	....[a]	....[a]	....[a]	...[a]	..[a]	..[a]	..[a]	....[a]	....[a]	...[a]	....[a]
29	8,590	1,602	941	49	10	3	..	1,302	12,497	600	13,097
Oct. 6	7,455	1,937	1,839	130	33	9	4	303	11,710	543	12,253
13	7,933	1,986	1,447	100	31	7	3	132	11,639	550	12,189
20	6,681	1,868	1,263	86	19	10	1	115	10,043	435	10,478
27	6,546	1,781	1,191	97	21	6	3	142	9,787	393	10,180
Nov. 3	7,519	1,907	1,042	73	15	8	5	136	10,705	354	11,059
10	7,311	1,639	772	66	13	4	2	146	9,953	336	10,289
17	7,202	1,402	719	43	7	1	3	111	9,488	292	9,780
24	7,176	1,340	904	56	12	10	..	100	9,598	298	9,896
Dec. 1	7,987	1,522	900	56	27	4	4	130	10,630	326	10,956
8	6,288	1,195	602	40	11	3	2	97	8,238	267	8,505
15	2,883	765	385	15	10	3	1	99	4,161	153	4,314
22	2,496	754	506	29	10	3	2	102	3,902	172	4,074
29	2,945	805	371	26	8	3	2	116	4,276	158	4,434
1923 Jan. 5	1,654	546	254	22	6	3	3	98	2,586	112	2,698
12	824	384	252	11	1	..	..	72	1,544	98	1,642
19	874	408	261	19	4	..	..	79	1,645	107	1,752
26	915	364	241	21	2	3	..	76	1,622	103	1,725
Feb. 2	565	275	224	10	1	1	..	63	1,139	57	1,196
9	383	203	186	10	1	2	..	40	825	44	869
16	159	131	106	6	1	..	..	14	417	22	439
23	328	214	119	9	1	1	1	20	693	40	733
Mar. 2	668	351	181	10	3	1	..	44	1,258	64	1,322
9	1,049	558	318	13	4	..	1	81	2,024	108	2,132
16	1,062	476	309	19	8	2	1	71	1,948	109	2,057
23	812	313	185	10	4	3	1	59	1,387	65	1,452
30	733	294	210	7	5	1	..	46	1,296	57	1,353
Apr. 6	1,317	410	284	17	8	2	..	69	2,107	92	2,199
13	1,351	489	316	12	3	1	..	63	2,235	89	2,324
20	1,199	439	214	20	8	1	1	50	1,932	66	1,998
27	486	169	62	14	1	..	..	21	753	31	784
May 4	1,916	469	280	20	5	3	..	52	2,745	104	2,849
11	1,440	447	284	17	9	3	..	13	2,213	117	2,330
18	929	379	243	24	7	2	..	13	1,597	72	1,669
25	609	327	266	16	7	..	..	11	1,236	69	1,305
June 1	681	263	170	11	8	2	..	13	1,148	43	1,191
8	803	240	132	12	2	..	..	9	1,198	45	1,243
15	1,046	276	196	19	9	1	..	12	1,559	86	1,645
22	1,064	345	151	36	13	6	..	32	1,647	85	1,732
29	1,213	386	194	68	18	3	1	28	1,911	81	1,992
July 6	871	289	136	47	9	1	..	35	1,388	72	1,460
13	750	235	125	56	20	2	..	32	1,220	69	1,289
20	433	173	127	46	14	1	..	16	810	57	867
27	350	162	74	26	7	1	..	15	635	47	682

* Data from the *Grain Trade News*.

[a] Not available. See text, p. 182.

TABLE II.—WHEAT INSPECTIONS AT WINNIPEG—*Continued*

(*Cars*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	No grade	Total	Other	Grand total
1923 Aug. 6	.....[a]	.....[a]	.....[a]	...[a]	...[a]	..[a]	...[a]	...[a]	.....[a]	.....[a]	.....[a]
13	.....[a]	.....[a]	.....[a]	...[a]	...[a]	..[a]	...[a]	...[a]	.....[a]	.....[a]	.....[a]
20	.....[a]	.....[a]	.....[a]	...[a]	...[a]	..[a]	...[a]	...[a]	.....[a]	.....[a]	.....[a]
27	181	77	133	9	11	..	45	12	468	530	998
Sept. 3	84	59	145	6	2	..	94	12	402	626	1,028
10	411	333	393	17	5	8	107	9	1,283	971	2,254
17	2,391	1,442	1,034	80	32	7	186	6	5,178	1,298	6,476
24	5,499	2,951	1,940	258	44	35	119	6	10,852	1,520	12,372
Oct. 1	6,032	3,078	1,876	294	51	22	94	59	11,506	1,170	12,676
8	5,558	3,097	1,500	175	51	11	68	155	10,615	835	11,450
15[b]	5,483	3,127	2,011	336	59	22	68	185	11,291	718	12,059
22	5,407	3,157	2,522	498	67	33	69	215	11,968	600	12,568
29	4,315	2,739	2,948	743	111	18	75	275	11,224	622	11,846
Nov. 5	4,104	2,757	2,824	682	121	42	73	217	10,820	537	11,357
12	3,909	3,053	3,460	829	148	55	94	134	11,682	620	12,302
19	4,092	3,299	3,311	756	146	48	55	162	11,869	582	12,451
26	4,560	2,976	2,976	720	159	47	82	109	11,629	585	12,214
Dec. 3	3,931	2,844	3,094	805	138	44	58	130	11,044	550	11,594
10	3,763	2,776	2,853	736	143	34	55	140	10,500	445	10,945
17	3,644	2,587	2,653	668	107	27	33	129	9,848	339	10,187
24	3,241	2,631	2,646	683	127	26	29	139	9,522	336	9,858
31[b]	1,938	1,608	1,610	414	77	14	17	82	5,760	205	5,965
1924 Jan. 7	634	585	573	146	27	3	5	24	1,997	74	2,071
14	630	590	587	147	33	5	6	25	2,023	97	2,120
21	308	431	432	130	25	8	2	18	1,354	85	1,439
28	298	436	411	120	29	6	6	18	1,324	67	1,391
Feb. 4	490	471	483	115	29	9	3	27	1,627	76	1,703
11	385	309	365	124	24	6	5	21	1,239	62	1,301
18	259	340	423	107	15	5	9	25	1,183	59	1,242
25	326	374	465	95	32	3	6	21	1,322	73	1,395
Mar. 3	330	267	325	73	18	3	6	31	1,053	77	1,130
10	354	267	329	123	20	4	6	31	1,134	71	1,205
17	384	324	427	96	20	2	3	28	1,284	61	1,345
24	352	268	331	87	19	2	3	26	1,088	87	1,175
31	330	244	265	74	14	2	5	27	961	80	1,041
Apr. 7	265	280	301	61	7	1	4	34	953	69	1,022
14	263	210	253	52	14	2	9	16	819	73	892
21	222	226	240	71	13	2	14	31	819	75	894
28	365	426	500	104	21	6	16	61	1,499	113	1,612
May 5	468	616	703	153	28	9	14	32	2,023	123	2,146
12	520	734	725	178	47	1	18	26	2,249	155	2,404
19	708	757	857	214	42	5	28	27	2,638	156	2,794
26	1,090	1,022	1,153	186	25	6	22	18	3,522	163	3,685
June 2	1,054	1,060	1,086	158	32	7	15	15	3,427	146	3,573
9	1,283	1,100	900	157	38	8	9	18	3,513	155	3,668
16	1,361	1,373	920	160	29	4	24	33	3,904	189	4,093
23	1,331	1,281	1,012	148	23	10	21	20	3,846	192	4,038
30	1,299	1,182	788	135	28	9	22	21	3,484	170	3,654
July 7	1,217	1,105	879	138	35	13	14	15	3,416	224	3,640
14	723	589	485	98	33	6	8	10	1,952	127	2,079
21	589	476	423	96	20	7	6	10	1,627	106	1,733
28	339	258	263	72	20	4	6	12	974	71	1,045

[a] Not available. See text, p. 182.
[b] Interpolated.

TABLE II.—WHEAT INSPECTIONS AT WINNIPEG—*Continued*

(*Cars*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	No grade	Total	Other	Grand total
1924 Aug. 4	218	156	160	43	6	1	1	6	591	73	664
11	129	94	131	34	4	1	3	6	402	37	439
18	45	56	91	16	4	...	...	...	212	40	252
25	23	49	53	5	2	...	...	7	139	10	149
Sept. 1	18	39	32	5	2	1	...	2	99	10	109
8	416	108	68	17	2	...	2	...	613	22	635
15	577	258	121	32	5	3	...	4	1,000	39	1,039
22	927	630	507	100	19	4	2	38	2,227	128	2,355
29	2,110	1,178	1,310	729	254	124	11	83	5,799	211	6,010
Oct. 6	2,324	1,496	1,486	1,224	621	387	49	181	7,768	244	8,012
13	1,820	1,441	1,194	1,042	480	321	82	351	6,731	213	6,944
20	1,842	1,447	1,134	851	400	221	39	582	6,516	144	6,660
27	1,272	1,312	1,421	1,311	616	341	100	999	7,372	377	7,749
Nov. 3	1,200	1,320	1,473	1,746	822	384	176	632	7,753	466	8,219
10	1,240	1,469	1,501	1,554	739	338	174	472	7,487	306	7,793
17	1,162	1,364	1,362	1,419	759	243	190	463	6,962	276	7,238
24	1,283	1,578	1,583	1,667	1,052	355	185	528	8,231	316	8,547
Dec. 1	1,289	1,532	1,606	1,711	987	313	196	462	8,096	281	8,377
8	807	962	952	1,233	679	240	99	354	5,326	127	5,453
15	518	600	565	747	365	131	55	330	3,311	134	3,445
22	344	344	429	517	359	105	33	199	2,330	101	2,431
29	195	254	217	278	209	55	25	149	1,382	58	1,440
1925 Jan. 5	105	151	150	144	98	18	18	104	788	34	822
12	116	144	169	192	132	37	11	168	969	69	1,038
19	179	184	199	254	159	52	21	192	1,240	65	1,305
26	189	164	188	227	168	57	14	195	1,202	70	1,272
Feb. 2	182	176	193	252	175	60	13	177	1,228	49	1,277
9	227	220	252	287	170	79	24	377	1,636	68	1,704
16	201	202	211	341	171	44	20	508	1,696	53	1,749
23	172	231	226	307	166	62	24	494	1,682	54	1,736
Mar. 2	255	231	237	294	159	53	24	533	1,786	29	1,815
9	337	337	329	284	183	66	31	598	2,165	47	2,212
16	224	233	255	265	137	34	9	438	1,595	35	1,630
23	304	273	344	307	154	47	17	582	2,028	55	2,083
30	360	338	329	339	177	69	22	619	2,253	60	2,313
Apr. 6	245	215	202	182	100	40	11	336	1,331	51	1,382
13	167	123	158	144	41	17	6	214	870	43	913
20	170	188	196	152	76	21	10	184	997	40	1,037
27	359	285	292	247	84	33	12	512	1,824	48	1,872
May 4	319	254	254	233	99	28	18	467	1,672	36	1,708
11	224	170	167	121	64	13	5	172	936	26	962
18	159	198	152	109	37	10	3	144	812	22	834
25	211	138	137	83	30	10	5	116	730	12	742
June 1	267	269	193	155	55	16	8	134	1,097	22	1,119
8	137	152	119	112	51	14	5	171	761	23	784
15	170	159	155	132	54	10	7	177	864	38	902
22	196	147	186	125	83	21	7	221	986	43	1,029
29	229	168	193	174	70	25	8	201	1,068	43	1,111
July 6	304	254	239	223	85	22	12	355	1,494	41	1,535
13	350	310	366	265	127	34	14	327	1,793	42	1,835
20	161	208	268	201	108	30	24	161	1,161	57	1,218
27	139	107	172	166	71	22	11	58	746	30	776

TABLE II.—WHEAT INSPECTIONS AT WINNIPEG—*Continued*

(*Cars*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	No grade	Total	Other	Grand total
1925 Aug. 3	46	73	73	67	33	10	2	25	329	16	345
10	45	52	50	45	17	6	2	12	229	12	241
17	42	27	19	32	10	2	..	13	145	4	149
24	26	38	38	42	12	3	..	22	181	6	187
31	44	173	154	36	9	3	..	58	477	29	506
Sept. 7	751	998	985	241	37	2	2	36	3,052	432	3,484
14	3,729	2,154	1,264	529	69	13	..	44	7,802	898	8,700
21	5,844	2,806	1,163	472	81	22	4	504	10,896	974	11,870
28	5,315	4,488	1,436	387	84	18	3	393	12,124	924	13,048
Oct. 5	4,287	4,762	1,618	421	65	25	8	526	11,712	822	12,534
12	2,145	3,652	1,697	327	52	7	3	472	8,355	374	8,729
19	2,100	3,407	1,333	231	53	8	4	650	7,786	275	8,061
26	1,847	3,086	1,481	178	42	7	1	1,226	7,868	297	8,165
Nov. 2	2,032	2,758	949	160	46	12	2	1,423	7,382	360	7,742
9	1,672	2,319	1,010	189	49	9	3	2,185	7,436	375	7,811
16	2,280	2,469	1,099	216	54	12	4	3,700	9,834	471	10,305
23	2,613	2,645	1,139	274	74	17	4	3,638	10,404	498	10,902
30	2,344	2,974	1,315	302	73	23	8	3,755	10,794	411	11,205
Dec. 7	2,247	2,994	1,434	284	62	7	6	4,077	11,111	347	11,458
14	2,350	3,210	1,723	303	96	14	12	4,488	12,196	381	12,577
21	2,442	2,776	1,300	258	62	21	8	3,799	10,666	286	10,952
28	865	1,310	774	123	25	10	3	1,833	4,943	103	5,046
1926 Jan. 4	456	957	474	109	37	5	3	1,632	3,673	85	3,758
11	333	567	390	85	22	3	1	1,550	2,951	188	3,139
18	93	233	199	47	15	3	..	609	1,199	54	1,253
25	65	198	155	35	10	1	..	425	889	31	920
Feb. 1	279	301	193	24	6	1	..	940	1,744	44	1,788
8	444	453	187	40	17	..	..	1,135	2,276	49	2,325
15	275	299	148	31	10	5	..	802	1,570	23	1,593
22	81	175	114	29	10	1	..	508	918	9	927
Mar. 1	26	74	70	15	3	..	..	273	461	14	475
8	36	78	64	9	1	..	..	274	462	6	468
15	31	61	64	12	8	1	..	326	503	8	511
22	36	40	27	7	3	..	..	279	392	5	397
29	87	70	33	17	1	6	..	225	439	4	443
Apr. 5	73	65	27	9	1	..	..	222	397	6	403
12	63	68	53	6	1	..	..	238	429	17	446
19	100	94	85	28	3	1	..	216	527	31	558
26	249	253	110	24	6	1	..	587	1,230	61	1,291
May 3	243	201	99	24	2	1	..	438	1,008	52	1,060
10	332	191	147	40	8	2	2	484	1,206	33	1,239
17	440	631	552	76	17	1	1	878	2,596	104	2,700
24	613	925	630	118	28	7	4	942	3,267	116	3,383
31	692	1,040	581	96	18	7	..	1,042	3,476	98	3,574
June 7	541	906	387	71	55	3	..	630	2,593	56	2,649
14	252	577	251	57	12	2	1	406	1,558	47	1,605
21	304	548	254	39	2	3	..	512	1,662	55	1,717
28	214	564	217	55	19	1	..	511	1,581	49	1,630
July 5	267	455	214	42	13	5	..	405	1,401	60	1,461
12	290	387	185	40	10	2	..	281	1,195	51	1,246
19	190	257	150	31	9	1	2	258	898	37	935
26	164	226	134	33	8	1	..	205	771	40	811

TABLE II.—WHEAT INSPECTIONS AT WINNIPEG—*Continued*

(*Cars*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	No grade	Total	Other	Grand total
1926 Aug. 2	109	170	119	17	6	2	...	110	533	28	561
9	50	88	58	10	5	1	...	39	251	10	261
16	13	40	25	5	1	...	...	18	102	7	109
23	24	59	38	4	...	...	...	25	150	4	154
30	38	323	388	9	...	1	...	27	786	53	839
Sept. 6	467	929	602	18	3	...	...	20	2,039	338	2,377
13	1,197	2,288	498	31	5	...	1	142	4,162	320	4,482
20	3,181	3,596	738	102	23	3	...	921	8,564	516	9,080
27	3,132	4,187	1,012	158	48	15	6	1,193	9,751	1,269	11,020
Oct. 4	2,590	3,731	1,084	213	72	18	13	1,131	8,852	1,109	9,961
11	1,741	2,839	837	179	73	23	10	2,319	8,021	852	8,873
18	1,292	2,666	693	151	71	21	10	3,858	8,762	1,936	10,698
25	1,299	2,506	548	118	51	21	11	5,382	9,936	1,227	11,163
Nov. 1	876	1,964	436	70	25	18	4	5,151	8,544	1,101	9,645
8	910	2,360	903	377	110	63	27	6,319	11,069	1,035	12,104
15	942	2,352	1,119	593	221	156	99	6,584	12,066	939	13,005
22	691	1,854	832	484	178	125	77	6,085	10,326	914	11,240
29	559	1,515	755	366	146	88	64	5,640	9,133	922	10,055
Dec. 6	173	466	241	159	52	25	12	2,301	3,429	570	3,999
13	166	533	278	137	52	20	15	3,441	4,642	866	5,508
20	112	252	92	45	18	8	6	2,255	2,788	459	3,247
27	130	332	127	94	36	19	4	2,782	3,524	511	4,035
1927 Jan. 3	126	365	197	220	112	55	23	3,905	5,003	674	5,677
10	117	427	195	164	65	41	11	3,495	4,515	557	5,072
17	79	191	74	40	35	20	3	1,881	2,323	375	2,698
24	44	96	55	38	20	14	2	1,252	1,521	193	1,714
31	84	125	28	20	16	8	5	1,666	1,952	176	2,128
Feb. 7	20	86	41	21	18	11	4	1,146	1,347	201	1,548
14	22	90	41	6	5	2	2	773	941	181	1,122
21	14	120	41	6	4	2	1	1,039	1,227	257	1,484
28	25	138	40	5	2	...	1	1,091	1,302	263	1,565
Mar. 7	21	83	32	22	6	1	2	869	1,036	293	1,329
14	33	131	66	19	6	3	...	1,393	1,651	288	1,939
21	32	140	66	41	10	9	5	1,725	2,028	222	2,250
28	41	103	43	27	6	6	...	1,398	1,624	126	1,750
Apr. 4	39	107	44	30	15	4	3	1,565	1,807	115	1,922
11	28	78	44	26	12	3	3	1,117	1,311	67	1,378
18	30	94	32	15	5	3	1	940	1,120	65	1,185
25	86	286	123	64	24	19	4	2,267	2,873	121	2,994
May 2	74	306	149	80	17	14	...	3,023	3,663	146	3,809
9	50	198	92	54	6	1	1	1,660	2,062	71	2,133
16	74	284	100	40	13	5	...	1,607	2,123	50	2,173
23	121	427	116	36	6	1	...	1,115	1,822	59	1,881
30	141	513	118	17	14	2	1	1,356	2,162	24	2,186
June 6	98	316	72	29	9	4	...	860	1,388	20	1,408
13	49	207	72	19	4	2	1	537	891	29	920
20	44	161	67	19	12	4	...	813	1,120	56	1,176
27	30	184	81	17	19	1	2	832	1,166	83	1,249
July 4	46	235	109	46	25	11	3	1,093	1,568	114	1,682
11	38	207	111	43	28	7	2	1,360	1,796	193	1,989
18	65	266	121	35	30	10	3	1,562	2,092	285	2,377
25	53	203	103	35	13	5	3	875	1,290	191	1,481

TABLE II.—WHEAT INSPECTIONS AT WINNIPEG—*Continued*

(*Cars*)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	No grade	Total	Other	Grand total
1927 Aug. 1	21	168	66	22	16	5	3	547	848	90	938
8	11	108	48	22	8	5	3	279	484	53	537
15	3	46	32	17	12	4	4	132	250	31	281
22	3	56	22	11	8	2	1	106	209	6	215
29	2	32	31	7	7	3	1	99	182	27	209
Sept. 5	5	27	31	6	6	3	...	83	161	10	171
12	64	165	321	118	26	8	1	183	886	129	1,015
19	240	655	525	201	77	33	9	128	1,868	390	2,258
26	130	535	559	287	118	53	17	644	2,343	1,248	3,591
Oct. 3	169	771	1,186	501	180	61	33	2,953	5,854	1,675	7,529
10	165	907	1,600	721	232	82	27	4,693	8,427	851	9,278
17	126	528	960	454	197	73	13	3,395	5,746	501	6,247
24	90	592	1,330	602	194	78	41	4,259	7,186	560	7,746
31	162	1,378	4,960	2,971	633	267	84	2,981	13,436	766	14,202
Nov. 7	145	1,403	4,197	2,218	609	229	90	2,640	11,531	516	12,047
14	91	1,005	3,045	1,660	564	229	108	3,966	10,668	489	11,157
21	85	890	2,711	1,552	539	238	97	3,933	10,045	494	10,539
28	58	745	2,999	1,543	555	275	108	4,699	10,982	690	11,672
Dec. 5	43	631	2,452	1,189	375	228	76	3,989	8,983	426	9,409
12	19	388	1,662	832	248	106	53	2,933	6,241	405	6,646
19	20	282	1,165	640	203	98	32	3,179	5,619	300	5,919
26	17	216	1,061	598	150	65	28	3,044	5,179	240	5,419
1928 Jan. 2	11	211	913	576	134	50	10	2,314	4,219	164	4,383
9	13	130	822	444	129	43	13	2,396	3,990	146	4,136
16	7	176	695	313	102	41	6	2,763	4,103	143	4,246
23	9	125	587	231	91	23	5	2,008	3,079	98	3,177
30	10	108	384	167	37	13	3	1,569	2,291	96	2,387
Feb. 6	9	105	325	122	34	15	3	1,347	1,960	75	2,035
13	9	187	369	123	32	8	4	1,696	2,428	76	2,504
20	11	158	355	117	36	12	6	1,598	2,293	58	2,351
27	6	148	317	103	28	4	1	1,361	1,968	66	2,034
Mar. 5	8	119	211	70	11	6	2	969	1,396	83	1,479
12	6	84	191	73	13	2	2	798	1,169	78	1,247
19	5	69	166	80	18	6	2	680	1,026	89	1,115
26	...	62	144	48	22	5	1	685	967	101	1,068
Apr. 2	1	43	119	42	12	3	...	453	673	68	741
9	1	33	69	26	4	1	...	270	404	36	440
16	1	50	166	69	21	7	...	554	868	67	935
23	...	28	149	63	10	...	1	376	627	31	658
30	7	56	226	112	36	11	3	615	1,066	135	1,201
May 7	12	88	343	183	54	16	3	710	1,409	74	1,483
14	42	237	716	460	110	54	12	1,450	3,081	157	3,238
21	18	150	656	499	108	39	14	1,702	3,186	100	3,286
28	17	168	747	524	110	44	12	1,297	2,919	98	3,017
June 4	34	128	484	312	98	33	9	618	1,716	107	1,823
11	21	139	601	444	160	54	28	860	2,307	95	2,402
18	19	143	744	473	195	84	29	1,321	3,008	128	3,136
25	13	159	902	492	206	94	28	1,542	3,438	109	3,547
July 2	16	152	871	448	141	88	32	758	2,506	90	2,596
9	7	116	690	327	124	68	22	819	2,173	152	2,325
16	4	117	601	386	137	57	22	592	1,916	125	2,041
23	11	104	594	345	145	51	15	476	1,741	86	1,827
30	7	76	306	188	72	36	16	247	948	67	1,015

TABLE II.—WHEAT INSPECTIONS AT WINNIPEG—*Concluded*

(Cars)

Week ending	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Feed	No grade	Total	Other	Grand total
1928 Aug. 6	3	46	161	100	50	25	6	145	536	23	559
13	2	31	116	68	29	13	5	64	328	15	343
20	1	19	84	14	14	16	3	33	184	27	211
27	5	76	66	32	16	5	3	38	241	27	268
Sept. 3	5	97	114	19	4	5	5	71	320	59	379
10	514	1,506	534	104	24	10	...	333	3,025	905	3,930
17	625	2,958	1,860	753	296	112	10	288	6,902	1,456	8,358
24	225	2,532	3,301	1,926	1,088	765	170	634	10,641	1,819	12,460
Oct. 1	136	2,046	3,062	2,191	1,895	1,845	440	200	11,815	1,937	13,752
8	127	1,652	2,700	2,188	2,230	2,455	722	143	12,217	1,660	13,877
15	175	1,409	2,142	2,015	1,847	1,873	676	91	10,228	1,154	11,382
22	106	1,311	2,215	2,013	1,886	2,115	690	88	10,424	1,407	11,831
29	89	1,479	2,074	2,032	1,833	1,993	656	71	10,227	1,285	11,512
Nov. 5	65	1,285	1,987	1,933	1,779	1,762	743	126	9,680	1,109	10,789
12	126	1,360	2,209	2,162	2,150	2,018	907	169	11,101	1,120	12,221
19	68	1,181	2,244	2,208	2,192	2,146	966	180	11,185	1,021	12,206
26	84	1,180	2,217	2,092	1,994	2,118	934	141	10,760	770	11,530
Dec. 3	90	1,267	2,330	2,347	2,101	2,218	793	152	11,298	736	12,034
10	101	1,003	1,833	1,817	1,803	1,733	523	121	8,934	548	9,482
17	86	778	1,338	1,419	1,440	1,238	341	155	6,795	386	7,181
24	39	529	970	1,077	1,030	754	162	80	4,641	210	4,851
31	16	304	591	624	530	410	100	42	2,617	73	2,690
1929 Jan. 7	3	207	330	421	350	225	65	63	1,637	46	1,683
14	8	148	300	373	347	269	56	28	1,529	59	1,588
21	6	80	193	273	281	186	35	26	1,080	49	1,129
28	4	60	156	163	173	146	31	11	744	31	775
Feb. 4	3	31	125	142	122	141	36	13	613	24	637
11	..	61	128	120	113	104	27	6	559	43	602
18	5	90	176	188	141	119	32	7	758	63	821
25	6	82	190	154	141	140	33	9	755	72	827
Mar. 4	6	128	220	241	184	139	31	14	963	107	1,070
11	17	188	286	349	260	222	51	26	1,399	129	1,528
18	20	219	393	401	346	247	70	31	1,727	105	1,832
25	14	186	372	377	304	244	62	29	1,588	92	1,680
Apr. 1	15	136	257	271	279	205	41	18	1,222	91	1,313

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WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 6 MAY 1929

SURVEY OF THE WHEAT SITUATION

DECEMBER 1928 TO APRIL 1929

ALTHOUGH the international statistical position continued easy and changed but little during December–April, wheat prices fluctuated rather widely, but remained at the lowest level since 1923–24. Hopes and fears centering about an extraordinarily cold winter throughout the Northern Hemisphere, which seemed likely to have damaged winter-wheat sowings, led to an increase of prices from early January to mid-February. It was more marked in Chicago and Winnipeg than in Liverpool and Buenos Aires. Thereafter a decline occurred, more extensive than the advance; it continued through the first third of May, and was nearly as great in Liverpool as in Chicago. The decline seems to have been due not only to an accumulation of evidence tending to show that winter wheat had not suffered unusual damage in most countries, but also to the pressure of extraordinarily heavy stocks in exporting countries, especially after the new Argentine crop began to move in large volume.

International trade was of record volume for the season. Low prices encouraged importation and consumption, especially in ex-European countries, which imported more wheat and flour than ever before. But in spite of the record shipments, the accumulation of stocks in exporting countries remained extraordinarily large. The prices of representative wheats in the United States were relatively too high to permit exportation in a volume consistent with the available supplies, and here the accumulation of stocks, principally in commercial channels, was most noteworthy. The volume of world trade for the crop year, as measured by net exports, now seems likely to approximate 950 million bushels, by far the largest total in history; but year-end stocks also seem likely to be of record size. Increased wheat consumption seems not to have caught up with increased production.

STANFORD UNIVERSITY, CALIFORNIA

May 1929

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

The central feature of the series is a periodic analysis of the world wheat situation, with special reference to the outlook for supplies, requirements, trade, and prices. Each volume includes a comprehensive review of the preceding crop year, and three surveys of current developments at intervals of about four months. These issues contain a careful selection of relevant statistical material, presented in detail in appendix tables for reference purposes, and in summary form in text tables and charts.

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Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.
Published by Stanford University for the Food Research Institute.

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FOOD RESEARCH INSTITUTE

STANFORD UNIVERSITY, CALIFORNIA

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The Food Research Institute was established at Stanford University in 1921 jointly by the Carnegie Corporation of New York and the Trustees of Leland Stanford Junior University, for research in the production, distribution, and consumption of food.

SURVEY OF THE WHEAT SITUATION

DECEMBER 1928 TO APRIL 1929

The international statistical position remained distinctly easy during the period under review, and apparently became slightly more easy. By late April exportable surpluses for the crop year as a whole appeared much the same in size as they seemed to be in mid-December, though probably somewhat larger in view of the record crop harvested in Argentina, which is not yet officially estimated. Import requirements also now seem slightly larger than they looked to be in mid-December, but not enough larger to offset increased surpluses.

If this analysis is correct, international wheat prices might well have declined slightly from their December level. In fact they rose a little in January and early February, but declined steadily thereafter. The advance was considerably smaller than the subsequent decline. Advancing prices now appear to have been due chiefly to exceptionally cold winter weather throughout the Northern Hemisphere, which aroused apprehension of abnormal damage to winter wheat; the upward movement was much smaller in Liverpool than in Chicago. Bullish enthusiasm was more pronounced in the United States than elsewhere, partly because many traders hoped for the passage of legislation which would raise domestic wheat prices. The March–April decline was coincident with increasingly favorable reports of the manner in which winter-wheat sowings had withstood the severe winter; it was greatest in Chicago, just as the earlier advance had been. By the end of April Liverpool futures prices had fallen to the lowest point of the crop year, and were close to the lowest point reached in post-war years, in 1923–24.

Relatively low prices and abundant supplies seem to have encouraged consumption of wheat for food, especially in ex-European countries; and wheat consumption for feed in Europe was encouraged also by the European shortage of corn. The volume of international trade was of record size. Ex-European takings accounted for an exceptional proportion of the heavy shipments, in part because the usual list of ex-European importing countries was increased by the addition of India. Canada, Argentina, and Australia furnished the bulk of the exports; despite our good crop and large visible supplies, the United States exported little. For the crop year as a whole, the volume of trade now promises to approximate 950 million bushels, 50 million more than our December estimate. Despite the heavy trade and consumption, world stocks of wheat at the beginning of April were exceptionally large. The United States, Canada, and Argentina held the largest stocks by comparison with other years; but only in the United Kingdom, Spain, Portugal, Asia Minor, and India can March stocks be described as distinctly low, while in other countries they appear to have been average or above. The extraordinarily high level of visible supplies in North America constituted one of the outstanding features of the period under review. The outlook is for continued heavy trade and consumption in May–July, and also for the largest world carryover of post-war years.

The outlook for the crop of 1929 is of course not clear at this season. The area to be harvested bids fair to exceed even that of 1928, except possibly in Russia; abandonment seems to be below average in the United States and apparently not much above average in Europe. With only an average yield per acre, the world wheat crop of 1929 may therefore be fairly large, and a crop as small as those of 1920–22 and

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1924 seems improbable. But unless yield per acre is again distinctly exceptional, it can hardly exceed the huge crop of 1928. Weather conditions in June and July, which are not predictable, will determine whether production in 1929 is to prove above or below the average of recent years. International prices in the closing months of the crop year will fluctuate with changing prospects for new crops; but existing heavy stocks in exporting countries will continue to act as a drag upon upward movements.

The present survey is written on the basis of information available to us on May 10. It covers the period December–March with respect to developments in international trade and stocks, but material for another month is included in the discussion of prices and of prospects for the crops of wheat to be harvested in 1929.

I. SUPPLY AND DEMAND FOR THE CROP YEAR

The international statistical position in 1928–29 remains unmistakably easy. Accumulated evidence on wheat supplies and "requirements" suggests that it differs little in early May from what it appeared to be in mid-December. The margin between exportable surpluses and import "requirements" remains the widest of post-war years except 1923–24, and lies somewhere between those of 1923–24 and 1927–28. Exportable surpluses now seem slightly larger than they did in December; but import "requirements" may be a little larger also. If the statistical position has changed at all, it appears to have become slightly more easy; but the change is not susceptible of precise measurement.

Changes in official estimates of crops during the period were unimportant in their effect upon the markets. The Canadian estimate was raised from 501 to 534 million bushels, the Australian from 154 to 159 million, the Czecho-Slovakian from 41 to 48 million, the Polish from 54 to 59 million. The Jugo-Slavian estimate was reduced from 105 to 96 million, the Spanish from 130 to 123, and the Algerian from 34.0 to 31.5. Other changes were trifling in amount. The first official estimates of the Danish and Swedish crops were 12.1 and 19.5 million bushels respectively, the largest outturns in history; the crop of Uruguay was placed at 15.2 million bushels, the largest in any year except 1927; and the crop of New Zealand was unofficially estimated at about 8 million bushels, some 1.5 million below the good crop of 1927. No official estimate of the Argentine crop has yet appeared, apparently because of changes in the staff of the ministry of agriculture, following the inauguration of a new political administration.

Table 1 summarizes the latest available official estimates of the wheat crops of 1928 in comparison with those of earlier years. Italicized figures represent our own adjustments of official data, except that, in the complete absence of official reports, the figure for the Argentine crop of 1928 has been reached on other grounds. According to these data, the world crop (ex-Russia, China, and Asia Minor) approximates 3,795 million bushels, over 200 million bushels larger than that of 1927, which was previously the largest post-war crop. India and Spain are the only large wheat-producing countries which had short crops in 1928; most countries harvested crops above average in size, and many (including Canada, Argentina, and possibly Australia) secured record outturns. Of the several continents, North and South America and Australia secured the biggest harvests as compared with earlier years. Europe had a distinctly good one; Asia and Africa had poor ones. The zone of comparatively poor yield per acre ran across northern Africa and Asia Minor, and eastward into India and apparently China.

The crop estimates for 1928 included in the table are subject to revision in later months. No striking alterations are in prospect, but the world wheat crop of 1928 may finally prove slightly larger than is indicated by Table 1. Preliminary estimates of disposition for 1928–29 afford no grounds for questioning the substantial accuracy of the standing official estimate for the United States crop, 903 million bushels. The Australian estimate of 159 million bushels,

however, is perhaps nearly 10 million bushels too low, according to apparently official advices[1] not yet confirmed by the United States Department of Agriculture, whose figures are employed in Table 1. The figures for Argentina and Canada require more detailed comment.

The crop of Argentina, which we carry at 300 million bushels, may vary considerably from that figure. Early in January Broomhall's agent in Argentina placed the crop at 312 to 320 million bushels. The *Times of Argentina,* as late as March 11, estimated the exportable surplus as around 6.75 million tons, which would imply a crop of around 320 million bushels. Shipments from Argentina during February–March, when most of the wheat must have come from the new crop, were of almost the same size this year as last. Since lower prices must have served to curtail exportation this year in so far as they affected it at all, one may infer from these data that this year's crop was larger than that of 1927, which appears to have reached or exceeded 275 million bushels. Since the export data do not afford convincing indications that Argentina produced as much as 320 million bushels, but suggest a crop larger than 275 million, we employ the intermediate rounded figure of 300 million.[2]

The Canadian official estimate of 534 million bushels seems likely to prove too low. From August 1 to March 31 about 450 million bushels had been delivered to railways by farmers in the Prairie Provinces; there were 60.5 million bushels left on farms; and at least 40 million bushels must be allowed for wheat fed on farms, delivered to country mills, and delivered in the other provinces of Canada during August–March. The total is 550 million bushels presumably accounted for out of a crop placed at 534 million. A similar result appears if one bases the calculation upon the inward carryover, net exports to March 31, disappearance for food and feed to March 31, and stocks on March 31. One may reasonably expect that the Canadian official crop estimate for 1928 will be revised upward; but the increase is not likely to be as large as that for the 1927 crop, which was raised from 440 to 480 million bushels on the first occasion that a Canadian "final" (January) estimate has ever been altered.

TABLE 1.—WHEAT PRODUCTION IN PRINCIPAL PRODUCING AREAS, PRE-WAR AND POST-WAR*

(*Million bushels*)

Year	United States	Canada	Soviet Russia	Lower Danube[a]	Other Europe	North Africa	India	Japan, Chosen	Northern Hemisphere ex-Russia[b]	Argentina	Australia	Southern Hemisphere	World ex-Russia[b]
1920.....	833	263	...	172	774	71	378	41	2,550	156	146	350	2,900
1921.....	815	301	...	212	1,002	98	250	40	2,725	191	129	376	3,100
1922.....	868	400	...	224	815	71	367	40	2,800	196	109	354	3,155
1923.....	797	474	419	260	989	106	372	35	3,050	248	125	427	3,475
1924.....	864	*275*	472	204	846	85	361	35	*2,685*	191	165	407	*3,090*
1925.....	*700*	*430*	730	296	1,094	105	331	40	*3,010*	191	115	360[c]	*3,370*[c]
1926.....	*870*	*415*	820	294	910	90	325	39	*2,955*	221	161	435[c]	*3,390*[c]
1927.....	878	480	749	278	983	106	335	40	3,115	*275*	117	*460*[c]	*3,575*[c]
1928.....	903	534	860	355	1,036	103	289	42	3,275	*300*	159	*520*[d]	*3,795*[d]
Average 1909–13...	690	197	759[e]	330	1,017	93	352	32	2,725	147	90	280	3,004
1923–27...	*822*	*415*	638	266	964	98	345	38	*2,960*	*225*	136	*418*	*3,380*

* Summarized from most recent official data for individual countries (see Appendix Table I), as reported by the U.S. Department of Agriculture, but figures in italics represent our adjustments for apparent underestimates of crops, as shown in Appendix Table XI, for years prior to 1928. Italicized figure for Argentina in 1928 represents our approximation. Totals exclude China, Asia Minor, Brazil, and a number of small producers. All estimates are for areas within post-war boundaries.

[a] Hungary, Bulgaria, Roumania, Jugo-Slavia.
[b] Rounded figures.
[c] Includes our estimate for Peru.
[d] Includes our estimate for Peru and Chile.
[e] Regarded as too low by some Soviet officials, whose estimate is 908 million bushels.

[1] Reported in *Northwestern Miller,* April 3, 1929.

[2] The United States Department of Agriculture estimate of the Argentine crop, as secured from analyses of weather conditions, yield, and acreage, stands at 255 million bushels.

With respect to quality, crops appear much as they did in December, distinctly good in most countries except Canada. In the United States, the spring bread-wheat crop was of especially good quality, though good milling qualities of amber durum were scarce; winter wheat was moderately good, though there was much bleached and some bin-burnt grain. European countries generally had crops of good quality, much better than those of 1927. The new Argentine crop is reported to be of excellent quality, and wheat weighing 64 pounds to the measured bushel is distinctly common. The new Australian crop is apparently even better in quality than that of 1927. F.a.q. standards of 61¾ and 62 pounds per measured bushel were established in Victoria and South Australia, the same as in 1927; but the standard for New South Wales was set at 63 pounds for 1928 as against 60 pounds for 1927.

The Canadian crop has consisted of the lower grades to a slightly greater extent even than in September–November; wheat grading No. 5, No. 6, and feed has constituted 39 per cent of inspections in September–March, as against the previously highest percentage of 13.1 in 1924–25. But so far as may be judged by a comparison of the distribution by grades in the total inspections with the distribution by grades of the wheat remaining in store at the end of March, the lower grades have moved into consumption about as rapidly as the higher grades. The evidence suggests that markets have been found for these lower grades even at rather smaller price discounts than prevailed in the preceding four years, and that most of this wheat has been used to make flour rather than animal feed. Most European countries have imported liberal quantities of No. 5; many have imported No. 6; and Japan and China have imported much No. 6 and feed as well as much flour made largely from these grades. The Oriental market for No. 6 was sufficiently active to give rise to higher prices at Vancouver than could be obtained at Winnipeg. The official estimate of wheat unmerchantable, issued April 16, was 5 per cent of the crop of 1928 as against 6 per cent of the crop of 1927. Thus wheat presumably fed to animals on Canadian farms amounts to much the same figure this year as last, since this year a smaller percentage was unmerchantable while the crop was larger. The view (expressed in our December survey) that the great bulk of the lower grades of wheat must be regarded as a part of the world's supply of bread wheat, and a part capable of affecting bread-wheat prices, now seems to be confirmed.

Changes in the Statistical Position

During the period under review, the trade press both in the United States and in Europe has occasionally sought to ascribe the firmness of prices in January and February in part to increasing tightness (or diminishing ease) in the international statistical position—to a reduction in the apparent margin between exportable surpluses and import "requirements," a reduction due to the appearance of larger "requirements" than had earlier been anticipated. It is of course impossible to trace with precision changes in traders' opinions respecting the international statistical position, though opinions doubtless have their effect upon short-time fluctuations in wheat prices. So far as the statistical evidence itself is a criterion, there seems to be little reason to suppose that the international statistical position has undergone any marked change between mid-December and mid-April.

During the intervening months the accumulation of data has tended to confirm our mid-December analysis of supplies available in the major exporting countries. The crops of Canada and the United States still appear to approximate 1,450 million bushels; and the view that most of Canada's crop is millable for one purpose or another is now more generally accepted. The Australian crop still seems to be 160 million bushels, perhaps a little larger. The Argentine crop, however, which we placed at a figure (then described as distinctly conservative) of 250 million bushels, now seems nearer to 300 million. In our judgment the total 1928–29 exportable surplus in these four countries may be said to appear somewhere around 25 million bushels larger than it did in mid-December. Apparently some reduction has occurred in

the probable exportable surpluses of the minor exporting countries. The crop estimates of Jugo-Slavia and Algeria were reduced, though reduction of the former was allowed for in our mid-December analysis; and the evidence suggests that domestic consumption of wheat for food and feed has proved larger throughout the Danube countries than seemed likely four months ago. All told, reductions in the surpluses of the minor exporting countries now appear partially to have offset increases in the apparent surpluses of the major exporting countries. Thus, the international position has not significantly changed with respect to total exportable surpluses, though these appear a little larger than they did in mid-December, in part because slightly smaller allowances ought now to be made for domestic utilization of wheat for feed in Canada and the United States than were made in our December survey.

Import "requirements" are far more difficult to evaluate. The term itself is ambiguous, as we have often had occasion to observe. In the present year its ambiguity is particularly unfortunate. The demand for wheat is always partially inelastic, or of such a nature that approximately the same quantities will be purchased whatever the price; and it is partially elastic, or of such a nature that much larger quantities will be purchased at low than at high prices. In the usage of the trade, the term "requirements" seldom carries this significant distinction; "requirements," indeed, are usually estimated by reference to the volume of international trade, actually recorded or in prospect. Thus the record volume of trade which had already transpired in 1928–29 was often referred to as evidence that higher prices were in prospect, despite the fact that this exceptionally large movement was clearly in great part the result of heavy shipments to ex-European countries where demand for wheat may be described with assurance as relatively elastic.

Some evidence has appeared which suggests that, in so far as import "requirements" for the crop year have changed during the past four months, they have become somewhat larger. About the only tangible new factor making for a decrease in apparent world import requirements was the appearance of revised estimates of wheat and rye crops in Europe. Net increases in the estimates of the wheat crop in Europe outside of Russia and the Danube countries amounted to 16 million bushels; estimates of the rye crop now stand only 7 million bushels higher than they stood in mid-December, reductions in the estimates for Spain and the Baltic states being offset by increases in the Polish and Czecho-Slovakian estimates. A more intangible factor making for smaller requirements is the fact that Russia has failed to appear as an importer, despite frequently reiterated statements in the trade press that she must be expected to do so.

Against these developments can be set a group of influences making for larger import requirements than seemed probable in December. The extraordinarily cold winter in Europe perhaps stimulated bread consumption generally, though prevalence of influenza in France at least may have acted in the contrary direction. A secondary result of the extreme cold was unusually extensive damage to potatoes stored in pits throughout central Europe, and hence some indirect encouragement to wheat consumption; but recent advices from Germany state that damage proved much less than had been feared. Another factor was the modification of milling restrictions or tariff duties by several countries. In December Spanish regulations were altered to permit admixture in flour of a greater proportion of imported with domestic wheat; Syria and Poland lowered duties or relaxed restrictions on imported wheat; and in March the Greek duties were reduced. These encouragements to wheat consumption were in addition to the relaxation of milling regulations in France and Italy which was mentioned in our December survey. Again, the mediocre prospects for the new Argentine corn crop may have acted to tighten the European situation, somewhat furthering substitution of wheat for corn and other feed grains; and net decreases in the estimates of European crops of corn, barley, and oats were 70 million bushels. Finally, the outlook for India's wheat crop now being harvested turned rather unfavorable, and perhaps served to increase the quantity of wheat which India could be expected

to import in the crop year 1928–29, or at least to diminish the possibility that she might export appreciable quantities in June and July 1929.

Obviously one cannot assign to any of these factors a numerical effect on import requirements for 1928–29. But their effect was doubtless somewhat to increase apparent demand for wheat in the technical economic sense, presumably by more than net upward revisions of wheat and rye crop estimates in importing countries would tend to decrease it. Hence we conclude that, while both exportable surpluses and import requirements have increased slightly during the period under review, the margin between them appears not much different in mid-April from what it appeared in mid-December. Conceivably the margin may have widened slightly, but certainly not appreciably enough to justify decidedly lower international wheat prices than have prevailed. The upward course of prices in January and February is in our judgment to be ascribed to other factors than a change in the international statistical position.

Probable Net Exports

Even with accumulated data upon trade, stocks, and crops in the exporting countries, estimates of probable net exports for the crop year 1928–29 remain subject to a fairly wide margin of error. Enough information is available, however, to suggest that revisions of our December estimates are desirable. These appear in Table 2 in comparison with Broomhall's estimates of probable shipments and with the United States Department of Agriculture's estimates of net exports for the crop year July–June.

Despite the large crop and huge visible supplies, net exports from the United States (July–June) now seem likely to reach only about 140 million bushels, some 15 million less than our December estimate. During the preceding seven years April–June net exports have constituted from 91 to 182 per cent of January–March net exports, or 91 to 136 per cent if we exclude the year 1926, when the transition from a distinctly short crop to a distinctly good one gave rise to unusually heavy exportation in April–June. Net exports in January–March 1929 were 21.8 million bushels. In so far as the seasonal movement of net exports in recent years is a useful criterion, one may expect April–June net exports in 1929 to range between 20 and 40 (more probably between 20 and 30) million bushels. In view of the small exports thus far reported for April, heavy exportable surpluses available in Canada and Argentina, the continued low level of prices with United States prices still out of line with import markets, we assume that April–June net exports bid fair to fall in about the middle of the indicated range, probably not much exceeding 25 million bushels. Since July–March net exports were only 113 million, total net exports (including an allowance of 2 or 3 million bushels shipped to possessions) will probably approximate 140 million for the July–June crop year. The figure may run higher if American prices quickly return to a level facilitating exportation, especially because railway freight rates on wheat destined for export have been reduced. August–July net exports may well exceed the July–June figure because exports in July 1928 were unusually small, and because stocks in commercial channels are exceptionally large.

Table 2.—Forecasts of Probable Net Exports by Exporting Countries in 1928–29*

(*Million bushels*)

Exporting area	Broomhall		U.S.D.A.		F.R.I.	
	Dec. 20	Feb. 12	Oct. 20	Feb. 26	Dec. 20	May 1
United States	136	136	200–220	150–175	155	140
Canada	368	400	345–390	375–400	420	430
Argentina	184	192	125–160	160–185	160	215
Australia	96	96	75–85	90–100	100	115
Russia	...[a]	...[a]	.....[a]	.....[a]	...	...
Danube basin[b]	40	40	65–90	31–47	50	40
India	...[a]	...[a]	.....[a]	.....[a]	...[a]	...[a]
Others	16	16	2–5[c]	2–5[d]	15[e]	10[e]
Total	840	880	812–950	808–912	900	950

* For crop year August–July, except U.S.D.A. estimates and F.R.I. estimates for United States exports, which are for the year July–June. Broomhall's figures are for probable shipments. Dots (..) indicate items for which no estimate was made.

[a] Net import.
[b] Roumania, Bulgaria, Hungary, and Jugo-Slavia.
[c] Algeria and Tunis.
[d] Algeria only.
[e] Algeria, Morocco, Tunis, Chile.

Canadian net exports, on the other hand, seem likely to reach about 430 million bushels, some 10 million more than our December estimate. The seasonal movement of Canadian net exports seems to afford a less satisfactory basis for estimating the size of the end-year movement than is true of the United States; but the relation between Canadian stocks on March 31 and April–July net exports has proved fairly constant during post-war years of large Canadian wheat crops. During such years April–July net exports have ranged from 47 to 52 per cent of total Canadian stocks on March 31, and these figures suggest that net exports of 115 to 127 million bushels may be expected in April–July this year. Since 314 million had been exported during August–March, the total for the year will probably lie between 429 and 441 million bushels; and we employ 430 million as a reasonable figure. Canadian railway freight rates were also reduced to meet the American; but existing congestion at Montreal and canals feeding this port suggests that the outward movement in May at least will perhaps prove moderate, size of crop and stocks considered.

Any estimate of the probable April–July movement from Argentina must remain scarcely more than a guess, in the absence of an official estimate of the crop, and of official net export statistics for the months of December, January, and March. Moreover, the seasonal movement in past years has been far from consistent, with variations attributable to an extremely complex group of circumstances. During the preceding six years, net exports during the months of January–March have constituted anywhere from 45 to 64 per cent of net exports during January–July. On this basis, since January–March exports were about 85 million bushels this year, one may expect January–July exports to range between 135 and 190 million, and April–July exports between 50 and 105 million. Perhaps something like the middle of this range, around 77 million, is as appropriate an estimate as the data justify. Net exports during August–March have approximated 140 million bushels, perhaps a little more; hence the total for August–July may reach 215 million bushels, or 55 more than our December estimate. Our earlier estimate, however, was admittedly conservative; and our present estimate is to be regarded merely as the middle of a wide range. Argentina may export fully 10 per cent more or 10 per cent less than 215 million bushels of wheat during the crop year 1928–29; in either event the total would constitute a new record.

Australia may usually be counted upon to export a little less wheat and flour in April–July than in January–March. In 1925 and 1927, when available supplies were similar in size to those of the present year, January–March exports were 56 and 45 million bushels respectively, and April–July exports were 49 and 45 million. This year, however, lower prices have prevailed and the harvest was somewhat early; hence April–July net exports will probably prove smaller in relation to January–March exports than was true in those years. Some 35 million bushels more or less — probably more, so far as the seasonal movement of past years is a satisfactory guide—may be exported in April–July, as against 53 million in January–March. Since exports in August–March were about 79 million bushels, the probable total movement for the crop year, in rounded figures, may reach 115 million or more. This figure is 15 million above our December estimate. It implies either stocks on August 1 improbably low in view of the low level of international wheat prices, or (more probably in the light of recent advices) a crop larger than 159 million bushels.

Among the minor exporting countries, India and Russia seem certain to furnish no net exports in 1928–29. The Danube countries, in spite of wheat crops apparently no smaller than they appeared to be in mid-December, have exported less than seemed probable at that time. Although net export data are incomplete, less than 30 million bushels of wheat and flour seem to have been exported from Hungary, Jugo-Slavia, Roumania, and Bulgaria in the first seven months of the crop year. Since exports from these countries tend to decline in the latter months of each year, net exports in 1928–29 seem unlikely to exceed 40 million bushels, a figure 10 million below our December estimate. Fragmentary data suggest further that net exports from Al-

geria, Morocco, Tunis, and Chile are more likely to approximate 10 than 15 million bushels.

All told, world net exports now appear likely to approximate 950 million bushels rather than 900 million, our December estimate—which, however, was set forth as a conservative one, especially with regard to the probable exports of Argentina and Australia. The total is much higher than Broomhall's standing estimate (published February 12) of probable shipments, 880 million bushels; but net exports always exceed shipments, and Broomhall has recently expressed the opinion that his estimate might be moderately exceeded.[1] Our estimate exceeds the middle of the range of the United States Department of Agriculture's estimate of July–June net exports (as published on February 26) by 90 million bushels. The differences arise principally from the fact that we regard the crops of Argentina, Australia, and Canada as considerably larger than the Department seems to do; but our methods of estimation also differ. Despite differences in detail, all observers substantially agree that the volume of international trade in 1928–29 will prove by far the largest in history. If net exports approximate 950 million bushels, the total will exceed that of 1927–28 by around 130 million bushels and that of 1926–27, when net exports were previously largest, by about 100 million. Approximately 675 million bushels had been exported between August 1 and March 31. The movement in the last third of the crop year is likely, as usual, to fall below a third of the year's total; and trade is not likely to prove so large in contrast with earlier years (especially 1923–24 and 1926–27) as it was in August–November and December–March.

II. INTERNATIONAL TRADE

International trade during December–March displayed much the same striking features as appeared in August–November. Exporting countries as a whole shipped record quantities of wheat and flour. An unusual proportion of the shipments came from Canada, Argentina, and Australia. The United States exported very little considering the size of her crop. The same was true of the Danube countries. India was a net importer rather than a net exporter, and Russia shipped practically nothing. Prevailing low prices furnished a stimulus to importation—most considerably in ex-European countries, where demand is relatively elastic, and least noticeably in western Europe, where demand is less elastic.

According to Broomhall's shipments data summarized in Table 3, some 346 million bushels of wheat and flour were shipped overseas in 17 weeks of the December–March period. This is over 15 per cent more than was shipped in 1926–27, when the movement in December–March was previously largest. In that year, moreover, shipments in the second third of the year received a stimulus not present this year; for the August–November movement had been curtailed by exceptionally high ocean freight rates, so that shipments in subsequent months in part represented the making up of arrears. Shipments to Europe of 245 million bushels in December–March 1928–29 were decidedly large, but not so strikingly so as total shipments. In 1926–27, indeed, more wheat was sent to Europe,

TABLE 3.—INTERNATIONAL WHEAT AND FLOUR SHIPMENTS (BROOMHALL) BY DESTINATIONS*

(*Million bushels*)

Year	December–March (17 weeks)			August–March (34 weeks)		
	Total	To Europe	To ex-Europe	Total	To Europe	To ex-Europe
1920–21..	181.4	164.9	16.5	355.6	326.9	28.7
1921–22..	223.6	180.8	42.8	441.0	365.4	75.6
1922–23..	225.9	196.0	29.9	444.7	385.2	59.5
1923–24..	270.1	203.0	67.1	492.0	380.5	111.5
1924–25..	272.0	242.1	29.9	527.0	470.5	56.5
1925–26..	234.7	175.6	59.1	442.2	342.3	99.9
1926–27..	299.1	252.8	46.3	531.9	449.1	82.8
1927–28..	272.7	222.9	49.8	524.6	443.8	80.8
1928–29..	346.1	245.3	100.8	649.2[a]	489.5[a]	159.7[a]
Average						
1909–14..	189.9	161.9	28.0	406.5	353.0	53.5
1923–28..	269.7	219.3	50.4	503.5	417.2	86.3

* Data from Broomhall's *Corn Trade News*.

[a] Thirty-five weeks.

[1] *Corn Trade News*, April 3, 1929.

and in 1924–25 almost as much. The exceedingly large total movement in December–March was due principally to record shipments of 101 million bushels to ex-European countries — 34 million bushels more than in 1923–24, when these countries previously imported most heavily, and 51 million more than in 1927–28.

If we employ trade figures covering two-thirds rather than one-third of the crop year, the huge volume of trade in 1928–29 is even more striking, even with allowance for the fact that we include shipments for 35 weeks in 1928–29 as against 34 weeks in other years. Total shipments of nearly 650 million bushels have already been recorded. This is a larger quantity than was shipped during the whole crop year in 1920–21 or 1921–22, and it is within 30 million bushels of the total quantities shipped during twelve months in 1922–23 or in 1925–26.

Certain contrasts with August–March shipments in earlier years are illuminating. This year prices were somewhat higher than in 1923–24, and the wheat crops of European importing countries in the aggregate were somewhat larger; hence if other things were equal, one would expect European imports to be smaller in 1928–29 than in 1923–24. But Europe has already taken over 100 million bushels more wheat in August–March than in the same period of 1923–24. "Other things" have not been equal. In particular, population and per capita consumption of wheat, which has increased partly because of increasing prosperity, have increased. Nearly 50 million bushels more of wheat and flour were shipped to ex-European countries in August–March 1928–29 than in the same period of 1923–24. This increase is attributable in part to similar factors difficult of measurement, but in part to the fact that India (shipments to which totaled 23 million bushels this year) was a net exporter in 1923–24, but a net importer in 1928–29.

Lower prices constitute an important (though not the only) reason why August–March shipments to Europe in 1928–29 have proved around 10 per cent larger than in 1927–28. Even with liberal allowance for the unknown annual increment in "requirements" due to population growth and increasing per capita consumption, one could hardly expect European countries to import more wheat this year than last at equivalent prices; for this year's wheat crop was both larger and of better quality, and so was the crop of rye. Lower prices undoubtedly account for a moderate proportion of the increased takings of Europe thus far in 1928–29. But another factor was the smaller crops of corn and of potatoes, their aggregate decrease (around 450 million bushels) being more than sufficient to offset the aggregate increase (around 75 million bushels) in the crops of barley and oats. One cannot describe the European feed grain situation as distinctly tight this year, except with respect to corn; but it was presumably such as to encourage more feeding of wheat to animals this year than last. A third factor is the greater need of Turkey for wheat; Broomhall's figures include shipments to Turkey, though the country as a whole should appear among the list of ex-European nations.

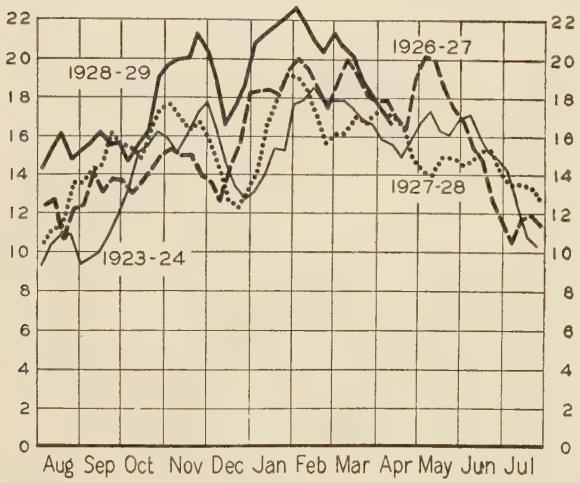
Heavier ex-European importations in 1928–29 have been due in considerable part to India's short crop, which accounts for around a fourth of the increase; somewhat to the shorter crop in Egypt, Asia Minor, and possibly China; to a smaller rice crop in the Orient; to growth of population and per capita consumption; but above all, so far as one can measure the various influences, to lower prices. Lower prices seem clearly to have exerted a greater influence on ex-European than on European trade.

The course of trade, expressed in the three-week moving averages of Broomhall's weekly shipments data, is shown in Chart 1 (p. 216). The usual decline occurred in December with the close of navigation on the Great Lakes. The subsequent rise was timed a little earlier than usual, but seems to have reflected an unusually large overseas movement from Canadian stocks stored in eastern lake and Atlantic ports rather than an unusually heavy seasonal movement from Argentina or Australia, though these countries both shipped exceptionally large quantities, and in Australia at least the harvest was early. Shipments reached their greatest height in the first two weeks of February, in each of which the total was 23 million bushels. Until the

present year weekly shipments of more than 20 million bushels were distinctly uncommon; but in the 18 weeks ending March 30, shipments exceeded 20 million bushels in each of 12 weeks.[1]

CHART 1.—INTERNATIONAL SHIPMENTS OF WHEAT AND FLOUR, WEEKLY, 1923–24, AND FROM AUGUST 1926*

(Million bushels; 3-week moving average)



* Broomhall's data, from the *Corn Trade News*.

DISTRIBUTION OF IMPORTS

The effect of lower wheat prices in increasing imports in 1928–29 over those of 1927–28 may be analyzed in more detail by reference to statistics of net imports, of crop production, and of Broomhall's shipments by destinations.

Broomhall's shipments by European destinations in August–March[2] 1927–28 and 1928–29 were as follows, in million bushels.

Destination	August–March 1927–28 (34 weeks)	August–March 1928–29 (35 weeks)
Orders	91.3	99.4
United Kingdom	109.7	109.6
France	19.5	30.1
Italy	44.9	51.9
Germany[a]	47.3	47.6
Belgium	43.0	39.3
Holland	53.5	49.9
Scandinavia	13.8	19.4
Greece[b]	9.8	14.7
Spain[c]	1.7	15.6
Austria[d]	9.2	12.0
Total	443.8	489.7

[a] Includes Poland and Czecho-Slovakia.
[b] Includes Turkey.
[c] Includes Spanish colonies and Portugal.
[d] Includes Malta.

These data constitute a somewhat unsatisfactory guide, since there is no way of ascertaining the final destination of wheat shipped to Europe for orders. They serve, however, to emphasize the significant facts. According to these data, considerable increases in imports have occurred in France, Italy, the Scandinavian countries, Greece and Turkey, Spain and Portugal, and Austria. There appears to have been little change in the imports of the United Kingdom and Germany (including Poland and Czecho-Slovakia), and a moderate decrease in the imports of Belgium and Holland.

Net import statistics covering the period August–February in the main confirm Broomhall's data, but with some qualifications. Such data show that Germany, Czecho-Slovakia, Poland, Switzerland, Holland, and Belgium have all imported (net) less wheat and flour this year than last; for these countries August–February net imports totaled 101.5 million bushels as against 124.6 million in 1927–28. But the fact that lower prices have encouraged importation is apparent when we consider that wheat and rye crops in these countries were over 140 million bushels larger this year than last, and of much better quality. The stimulus of low prices is also apparent with regard to the Scandinavian and Baltic countries. Here the wheat crops totaled 43.0 million bushels in 1928 and only 31.4 million in 1927; but net imports in August–March 1928–29 have reached 25.1 million bushels as against 20.4 million in the same period of 1927–28. In part, however, increased imports in these countries were due to slightly smaller crops of rye.

French imports also appear to have been stimulated by lower prices, though in the absence of comparable net import statistics[3] the conclusion that August–March imports were larger this year than last must rest upon Broomhall's shipments data. France had a domestic wheat crop of about the

[1] See Appendix Table V.

[2] Analysis of December–March data is hardly necessary since these show much the same features as August–March data.

[3] Data are available only for August–December. These show net imports of only 21.2 million bushels this year as against 29.3 million in 1927–28. But net imports were overstated in early 1927–28; see WHEAT STUDIES, May 1928, IV, 244.

same size in 1928 and 1927, but much better in quality this year. Imports and consumption may have been stimulated not only by lower prices, but also by relaxation of milling restrictions. One cannot ascertain how far larger available supplies indicate increased consumption, how far upbuilding of stocks.[1] In Italy also other forces as well as lower prices acted to increase net imports in 1928–29 over those of 1927–28. Although the Italian crop of 1928 was over 30 million bushels larger than that of 1927, her net imports in August–February were 10 million bushels larger also. The short corn crop and the relaxation of milling restrictions have doubtless stimulated consumption of wheat. Competent observers, however, are of the opinion that net imports in April–July will prove considerably smaller this year than last, so that by the end of the year the contrast of net imports and total available supplies as between the two years may be less striking.

Net import statistics are not available for Spain, Portugal, Austria, and Greece. Spain and Portugal, however, have undoubtedly imported much more heavily this year than last, as Broomhall's shipments data suggest; but the increase has probably been due more to much shorter wheat crops than to lower wheat prices. The stimulus of lower prices appears scarcely to have affected British imports; these were about 143 million bushels in August–March 1928–29 as against 156 million in the same period of 1927–28, despite a smaller domestic wheat crop of 1928, which was, however, of far better quality than that of 1927. British importers appear to have waited patiently this year for still lower prices than those prevailing in the first half of the year; and with the recent extensive decline of prices they may choose to make up arrears. All told, lower wheat prices appear to have had the least effect in stimulating net imports in the British Isles, Spain, Portugal, France, Switzerland, Belgium, and Holland, and their greatest effect in Germany, Czecho-Slovakia, Poland, the Scandinavian countries, and the Baltic countries. The situation in Italy, Greece, and Austria is not yet clear.

Practically all groups of ex-European importing countries imported far more wheat this year than last. The distribution of Broomhall's shipments to ex-Europe in August–March is as follows, in million bushels.

Destination	August–March 1927–28 (34 weeks)	August–March 1928–29 (35 weeks)
Central America[a]	30.4	45.4
China and Japan	21.2	52.2
Brazil	18.0	19.4
Egypt	5.4	12.9
North and South Africa	3.7	5.7
India	1.5	23.0
Others[b]	.6	1.1
Total	80.8	159.7

[a] Includes Venezuela, West Indies, Dutch East Indies, etc.
[b] Chile, Peru, Syria, Palestine, New Zealand.

The small increase in takings of the "others" group is probably to be ascribed to smaller wheat crops in Asia Minor and New Zealand. The moderate increase in Egyptian takings is also to be ascribed in some part to smaller native wheat supplies; and the large increase in Indian takings is undoubtedly due to the same factor. But Brazil, the group called "Central America," and North and South Africa must have increased their imports principally on account of lower prices, since little wheat is produced in Brazil or "Central America," while the South African crop was larger in 1928 than in 1927. The greatly increased imports of China and Japan are less readily explained. They were due in part, perhaps, to a shorter rice crop in both countries, and in China to a shorter wheat crop in the neighborhood of Tientsin, as well as to a more stable social order which seems to have resulted in better conditions of domestic transportation; but lower wheat prices were probably the dominating influence.

Sources of Exports

In their distribution by countries of origin, exports of wheat and flour during

[1] Our correspondent, M. Augé-Laribé, states that the decree of December 4, 1928, permitting millers to manufacture pure wheat flour of any extraction, could hardly have had any effect on bread consumption for six or eight weeks thereafter because bakers first chose to dispose of their accumuluated stocks of flour containing admixtures of other cereals. Later, although the extreme cold weather may have tended to increase bread consumption, an epidemic of influenza may have acted in the contrary direction. The situation can become clear only in later months.

December–March displayed much the same characteristics as they did in August–November. Broomhall's shipments by countries of origin, together with official data on net exports from the four principal exporting countries, appear in Table 4.

India shipped practically nothing, and was indeed a net importer of over 12 million bushels of wheat in the three months of December–February, the result of the short crop of 1928. Russia also has shipped next to nothing, despite her record postwar wheat crop of 860 million bushels. There may not be a true shortage of wheat in Russia as a whole; but, thus far in the year at least, collections of grain have proved so small that rationing of bread was put in force in several of the principal cities, and exports were impossible. The prices paid by official collecting agencies for grain are for various reasons regarded as too low by the peasants, who choose either to store or to consume their produce in the face of active official efforts to obtain it. Despite the shortage of bread grain in the consuming centers, Russia has thus far disappointed confident expectations, repeatedly and prominently expressed, that she would import heavily. Chile, the French dependencies of northern Africa, and the Danube countries have exported fair quantities of wheat, but not large ones in view of the good crops. In the Danube countries the shortage of corn has led to an increase in both the feed and the food use of wheat. But this is not measurable and may not have been heavy. Farmers, dissatisfied with low wheat prices, have apparently kept their stocks at unusually high levels.

Of the four major exporters, all except the United States exported record quantities for the season in December–March. So much was to be expected in view of the huge crops secured in Canada, Argentina, and Australia. In some part, however, the record movement from both Argentina and Australia occurred because exceptional supplies of old-crop wheat were available for export in December, before the excellent new crops began to be marketed in volume. Size of crops considered, the December–March movement from these two countries was not exceptionally rapid. If, as seems probable, the Argentine crop of 1928 exceeds that of 1927, she could have exported much more in January–March 1929 than in the corresponding months of 1928; but the actual difference was small. Similarly Australia could have exported in these months more than she did in 1925, but in fact the exports were a little smaller this year. Canada, however, exported rather more rapidly this year than last; last year the damp condition retarded the movement.

TABLE 4.—INTERNATIONAL SHIPMENTS AND NET EXPORTS OF WHEAT AND FLOUR FROM PRINCIPAL EXPORT AREAS, DECEMBER–MARCH, 1922–29*

(*Million bushels*)

Dec.–Mar.	International shipments (Broomhall)								Net exports from			
	Total	North America	Argentina	Australia	Russia	Balkans	India	North Africa and Chile	United States	Canada	Argentina	Australia
1922–23	226.0	139.6	52.8	24.8	....	2.0[a]	6.8	...	49.0	84.3	56.6	25.1
1923–24	270.0	159.2	56.0	33.2	10.4	10.4[b]	.8	...	34.6	117.0	65.2	38.9
1924–25	272.0	116.8	66.0	60.4	....	14.0[b]	14.8	...	63.4	61.9	65.0	60.0
1925–26	234.8	128.8	33.6	40.8	4.8	12.0	14.8[c]		21.8	116.4	35.5	42.2
1926–27	301.6	159.2	60.8	49.6	20.4	10.4	.4	.8	42.3	100.6	69.5	51.3
1927–28	272.8	149.6	82.4	27.6	.8	10.0	.4	2.0	32.1	113.2	93.9	27.1
1928–29	346.4	176.0	93.6	60.4	....	14.4	....	2.0	32.8	124.7	100.0[d]	60.8[e]

* Shipments figures are Broomhall's cumulative totals for seventeen weeks from the *Corn Trade News*. These totals for the Balkans, Russia, North Africa, and Chile, do not agree with the weekly data given in Appendix Table V. Net exports are official data.

[a] Includes some shipments from Manchuria.

[b] Includes some shipments from Mesopotamia.

[c] German shipments of 14.4 million bushels included.

[d] Rough estimate based on Broomhall's shipments data, which usually understate Argentine net exports in December–March.

[e] March exports estimated from Broomhall's shipments.

Low prices, which have stimulated imports, have served somewhat to reduce efforts toward export, though not markedly.

December–March net exports from the United States were only 32.8 million bushels, the smallest quantity exported in any similar period of recent years except 1927–28 and 1925–26. Such small exports were all the more remarkable this year on account of the large crop and visible supplies of record size. Some 22.5 million bushels of the total consisted of flour as wheat, the remainder of Pacific wheat, durum, and other unrepresentative types. United States prices of representative wheats were maintained above export parity, a situation resulting principally from a broad outlook for higher prices which was based partly on a crop scare in mid-winter and the possibility of governmental price-raising measures,[1] and perhaps also the expectation of lower yields in 1929.

Several minor features of the recent export movement are of interest. Under the import certificate system, eastern Germany continued to export fairly large quantities of domestic wheat. Exports of flour from the Pacific Coast ports of the United States, chiefly to the Orient, were of the largest volume since 1923–24. The Pacific ports of Canada exported larger quantities of wheat and flour than ever before. Shipments from Argentina to "orders" were much larger this year than last, and at times unsold cargoes in this category exerted considerable pressure on European markets.

III. VISIBLE SUPPLIES AND OTHER STOCKS

Statistical data on stocks in most countries are insufficient to permit either a detailed comparison of the position as of the end of March 1929 with earlier years, or a comparison of the reduction of stocks in December–March 1928–29 with the reductions of earlier years. In the major exporting countries and the Danube basin, but not in India, stocks have persisted at extraordinarily high levels throughout the period under review. In ex-European importing countries, consumption for food and feed has undoubtedly been unusually heavy, even considering the trend; but there is no evidence to suggest that the increase of consumption in 1928–29 has thus far been of sufficient magnitude to offset the large crops and heavy imports. With some exceptions, notably Spain, Portugal, and the British Isles, stocks at the end of March seem to have stood relatively high in most European and ex-European countries as well, but by no means so remarkably high as in North America and in Argentina. Throughout the period under review the presence of exceptionally large stocks in various positions has acted as a depressing influence on wheat markets.

Exporting Countries

Visible supplies in North America and afloat for European destinations are shown in Chart 2 (p. 220). The total has run above 400 million bushels in most of the period, higher by 100 million bushels or more than in the previous year of highest visibles, 1927–28. Visibles in Canada and the United States, not visibles afloat, were responsible for the high total figures. Despite extraordinarily heavy total shipments overseas, reported figures for stocks afloat have not run exceptionally high. They might have done so if they were calculated to include stocks afloat for ex-European countries; as we have seen, shipments to these countries were relatively larger than shipments to Europe by comparison with earlier years.

The extraordinarily large visible supplies in the United States were due primarily to the restricted flow of wheat to export from a distinctly large crop and inward carryover. Yet a relatively rapid movement from farms to terminal markets was partly responsible. Stocks on farms and in country mills and elevators were officially estimated at 227 million bushels on March 1 this year, following the largest crop (except that of 1919) in the ten years 1919–28. In four of the nine years of smaller crops, March 1 stocks in these two positions were larger than they were this year; and farm stocks were larger in three. The movement from farms this year, size of crop considered, is

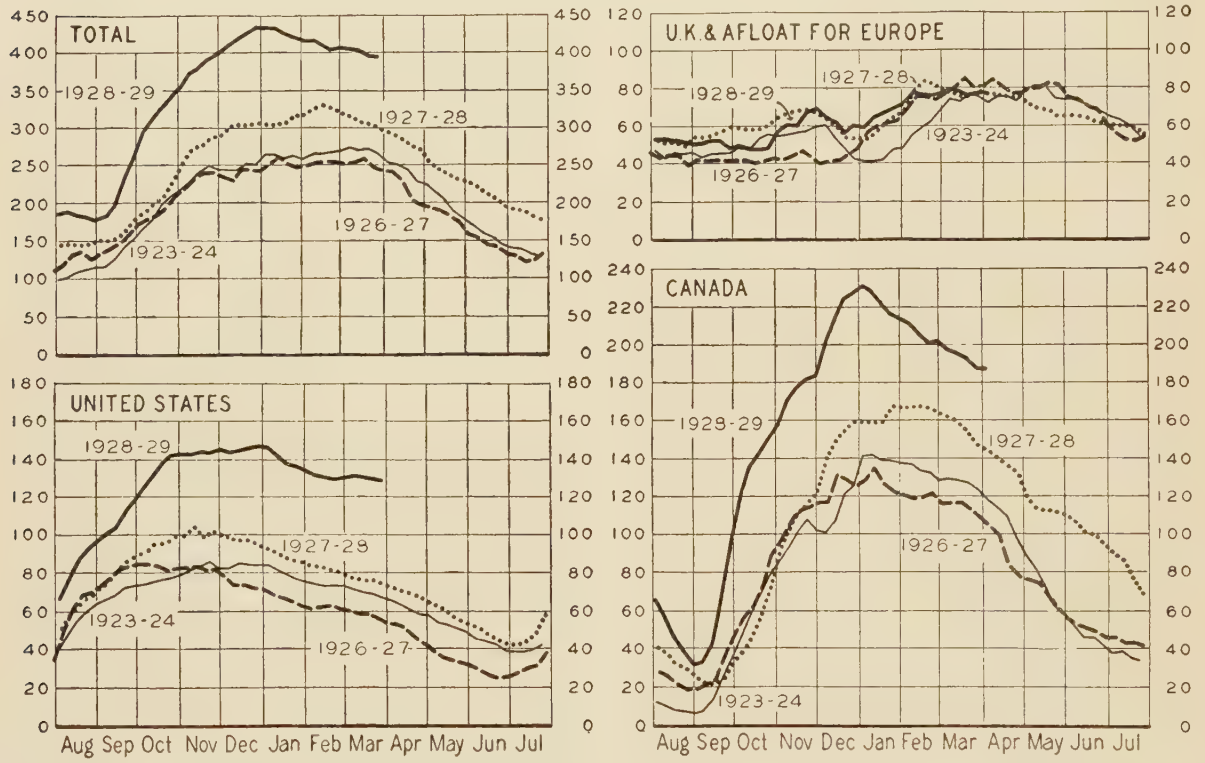
[1] See below, p. 225.

better described as about normal than as slow. Visible supplies might have run even higher if mills had not chosen to maintain their stocks at a high level. On December 31, 1928, according to census estimates, stocks held by city mills (excluding wheat stored in public terminal elevators and in country elevators) were 138 million bushels, over 20 million more than in any of the preceding three years for which comparable data are available. On March 31 these stocks reached 107 million bushels, more than 15 million bushels higher than in any of the three preceding years.

All told, stocks in the United States comprised in the visible supply (Bradstreet's), in country mills and elevators, and in the hands of farmers on March 1 reached 357 million bushels, some 70 million bushels more than the year before, and the largest since 1919. Of the visible supply, little was concentrated at the seaboard; the large holdings were in Duluth, Minneapolis, Chicago, Kansas City, and various points in the interior. Farm stocks, totaling 149 million bushels as against 130 million in 1928, were distinctly larger only in the states of Kansas, Oklahoma, Nebraska, North Dakota, and Minnesota, and were considerably smaller in most states east of the Mississippi.

CHART 2.—VISIBLE WHEAT SUPPLIES IN THE UNITED STATES, CANADA, AND UNITED KINGDOM PORTS AND AFLOAT TO EUROPE, WEEKLY, 1923–24, AND FROM AUGUST, 1926*

(Million bushels)



* Data from *Canadian Grain Statistics* and *Northwestern Miller.*

The enormous Canadian visible supplies reached their peak of 231 million bushels in the first week in January, a peak some 65 million bushels higher than the highest point reached in 1927–28, late in January. This year the earlier harvest and drier condition of the grain permitted more wheat to be moved to lake and Atlantic ports of the United States before lake navigation closed in mid-December; and the sharper decline in visibles during January was due partly to heavier shipments overseas from these stocks. Moreover, marketings from farms in January–February were considerably

smaller this year than last, though they became larger in March.[1] At the end of March, Canadian visible supplies of 188 million bushels were 40 million larger in 1929 than those of 1928—a figure high by comparison with earlier years, but not a high one in view of the fact that the crop plus carryover in 1928–29 appears to have been nearly 100 million bushels larger than that of 1927–28, while stocks on farms on March 31 (which are not included in visible supplies) were smaller this year than last. The export movement appears to have been relatively more rapid this year than last, despite the immense quantities of wheat grading No. 5 and below. Total stocks of Canadian wheat in Canadian positions[2] on March 31 were officially placed at 244 million bushels as compared with 225 million in 1928; hence total stocks were only 20 million above those of 1928, though visibles were 40 million above. This discrepancy may be explained in part by the fact that the visible supply includes wheat in United States lake and Atlantic ports, while the statement of March 31 stocks does not; and this year stocks in the United States were around 10 million bushels larger than they were a year ago.

Wheat stocks in other exporting countries are less easy to evaluate. Argentine stocks of old-crop wheat were thought to approximate 13–16 million bushels as of December 31, 1928, about a normal amount.[3] Since the export movement during January–March was no larger than in 1928, while the new crop appears to be larger, stocks in Argentina at the end of March presumably stood at a record height; the crop of 1927 was much the largest up to that year, and that of 1928 seemingly exceeds it. The whole subject of Argentine stocks, however, is obscure. Visible supplies in Australia were unofficially placed at 53 million bushels on April 1, 1929—some 17 million bushels higher than on the same date in 1928, but the same as in 1927 and 10 million lower than in 1925. Data on farm stocks are not available, but there is no reason to suppose that these were small. Presumably total stocks in Australia at the end of March were well above average in size, but not so strikingly large as those in the United States, Canada, and Argentina.

In view of their bumper crops and moderate exports, the Danube countries presumably hold the largest stocks in post-war years, although much more wheat than usual has undoubtedly been used for food and feed. In India, on the other hand, stocks of old-crop domestic wheat presumably stand at a very low level, for net imports have not been large enough to bring total available supplies within 20 million bushels of the average domestic utilization in 1922–27. A somewhat similar situation occurred in 1922 following the short crop of 1921. In Russia the situation is entirely obscure. Since the 1928 crops of wheat and rye combined were smaller than those of 1927 (though the crop of wheat alone was larger), there has probably been a reduction of total bread-grain supplies. Peasants in the northeastern sections of the producing regions may have ample wheat stocks, but apparently stocks in the consuming regions and probably in the southern producing regions are small.

Thus the major exporting countries held aggregate stocks of record size at the end of March 1929. If we disregard Russia and assume that heavy supplies in the Danube countries about balance the deficiency in India, it is possible to conclude that total stocks in exporting countries stand at the highest figure of post-war years. An unofficial compilation of visible supplies in North America, Argentina, Australia, ports of the United Kingdom, and afloat to Europe gives a figure of 497 million bushels on April 1, 1929, 115 million more than in 1928, when these stocks were the highest in the period 1920–28.[4] The statement is at best incomplete, but it suffices to emphasize the extraordinarily large stocks in commercial channels this year.

Importing Countries

During the period under review, the European trade press has referred fairly con-

[1] See Appendix Tables II and III, which show receipts at Fort William and Port Arthur and Vancouver. These figures, however, do not constitute a clear picture of the movement from farms.

[2] See Appendix Table X.

[3] See estimates by *Times of Argentina*, issue of January 14, 1929, p. 30.

[4] See Appendix Table VII.

sistently to a supposedly low level of stocks in European importing countries. It is practically impossible, however, to ascertain how far these references were intended to apply to port stocks, to mill stocks, or to farm stocks. So far as stocks of import wheat are concerned, it is reasonable to suppose that these have run fairly small at least in the United Kingdom, France, Belgium, Holland, and Germany, except for a period in February–March when the cold weather closed navigation by canal and river and caused heavy accumulations at Antwerp, Rotterdam, and Hamburg.

Evaluation of the general stocks position in European importing countries, however, must begin with recognition of the fact that these countries secured distinctly large crops of wheat and rye of good quality in 1928, and that imports have been larger than ever before. It is safe to say that available supplies of bread grain in European importing countries thus far in the year have been larger than in any other post-war year, 1925–26 possibly excepted. In that year the wheat and rye crops were larger; but they were of poorer quality, initial stocks were smaller than they were this year, and August–March imports were also smaller. The significant problem is to determine if consumption of wheat for food and feed this year has been heavy enough to bring total available supplies at the end of March to something like an average or a relatively low level. A precise answer is impossible. Doubtless total consumption for food has been larger than ever before, the result not only of low prices but also of growth in population and per capita consumption. Feed use of wheat may also have been relatively heavy on account of the scarcity of corn; but the generally good quality of this year's wheat crop presumably militates against abnormally heavy feeding of wheat to animals. On the general principle that customs change slowly in food consumption, we doubt if, in European importing countries as a whole, the heavy available supplies of wheat can have been reduced so greatly that total supplies at the end of March were below average. Stocks of import wheat may have been low in many countries, and of native wheat in some countries; but in general supplies were probably average or above because farm stocks remained heavy in many countries.

In a few countries, total stocks were presumably lower than usual at the end of March. Spain and Portugal had small initial stocks and short crops, and imports seem not to have been large enough to compensate the deficiency. The British Isles also appear to have small stocks, for the crop was the smallest of post-war years; farm stocks in England and Wales were apparently not large on January 1;[1] and imports during the first eight months of the year were somewhat smaller than usual. In Germany, farm stocks on March 15 were somewhat lower than in 1928; stocks of wheat and flour in Berlin were lower also, as were stocks of import wheat in the interior; but port stocks were large because of the accumulation caused by closing of canals and rivers.[2] All told, German stocks of wheat (but not rye) seem to have been somewhat lower at the end of March this year than last, despite the larger wheat crop; but the difference seems not to be striking, and the level of wheat stocks is not to be described as below the average of recent years.

Most other importing countries of Europe presumably hold relatively heavy stocks. Fragmentary information suggests that farmers in many countries have marketed slowly, dissatisfied with the low level of prices; it is broadly probable that low prices encourage holdings as well as consumption of wheat; and, as we have observed above, consumption seems unlikely to have kept pace with increases in available supplies due to exceptional crops and imports. All told, it seems likely that large stocks in Poland, Czecho-Slovakia, Italy, and the Scandinavian countries especially fully offset small stocks in Spain, Portugal, and the United Kingdom. Stocks in European importing countries generally may reasonably be said to stand somewhat higher than they did in 1928, and above average. But the contrast with earlier years is by no means so marked as appears with reference to the major exporting countries.

[1] They were unofficially estimated as about 21 million bushels as against 27 million in 1928 and 21 million in 1927.

[2] Information from our correspondent, Dr. N. Jasny.

The stocks position in ex-European importing countries is more obscure even than the position in Europe. On the whole one may suppose that some increase over 1928 and over the average has occurred, if only because imports have been so exceptionally large. But in these countries consumption of wheat for food is probably subject to greater year-to-year variation than it is in Europe; the stimulus of low prices is presumably stronger in increasing actual consumption. Reports suggest that in Japan stocks of import wheat are noticeably high, and perhaps in Egypt also; but only the most indirect evidence is available for other countries. The fact that most of these except China and South Africa are tropical countries where flour stocks are never accumulated in large volume tends to support the view that the extraordinarily heavy imports of ex-Europe have in large part passed into consumption.

IV. WHEAT PRICE MOVEMENTS

The Level of Wheat Prices

Cash wheat prices on the international market and on the markets of the principal exporting countries remained on a relatively low level during December–March 1928–29, much as in the preceding four months of the crop year. A broad view of the situation is given in Chart 3 (p. 224), which gives comparisons with 1927–28 and 1923–24.

British parcels prices, which may be taken to represent weekly average c.i.f. prices of wheat moving in international trade except in so far as other countries purchase different grades and varieties of wheat, ranged between the lowest post-war level of 1923–24 and the moderate level of 1927–28, far below the levels (not shown in the chart) of 1924–25, 1925–26, and 1926–27. The present crop year has continued to be one characterized by decidedly low international wheat prices. The level of 1928–29 has ruled above that of 1923–24, we infer principally because import requirements have grown considerably in the interval of years. If size of world crops alone, or size of exportable surpluses alone, determined the relative levels of international prices in different years, the level of 1928–29 would inevitably have fallen below that of 1923–24. By contrast with 1927–28, international prices are lower in 1928–29 principally because exportable surpluses are much larger, while import requirements show a much less marked increase.

In our judgment the margin between exportable surpluses and import requirements has changed only slightly during the winter months, and if anything became a trifle wider. Hence, in so far as international prices may be held to be governed solely by the international statistical position, British parcels prices ought to have maintained their December level or to have declined slightly. In fact they rose in January–February, and declined in March. This movement appears to have resulted from factors extraneous to the international statistical position of 1928–29. It is discussed below.

Weighted average cash prices at Winnipeg[1] stood at much the same level relative to 1923–24 and 1927–28, and followed much the same course, as did parcels prices. With allowance for a less marked upward movement in January–February, natural enough because the new crop was then being harvested, Argentine prices were consistent with British and Canadian. Weighted average prices in the United States, however, apparently ran closer to prices in 1923–24 than was true of prices either in Canada, Argentina, or the United Kingdom.

Wheat prices in European countries[2] have not uniformly run lower in December–March 1928–29 than in 1927–28. In England, for example, native wheat sold at almost the same prices this year and last, despite the fact that prices of domestic and of imported wheat might ordinarily be expected to show similar changes because England imports most of her wheat and imposes no tariff duties. Similar prices in the two years seem chiefly attributable to the poorer quality of English wheat in

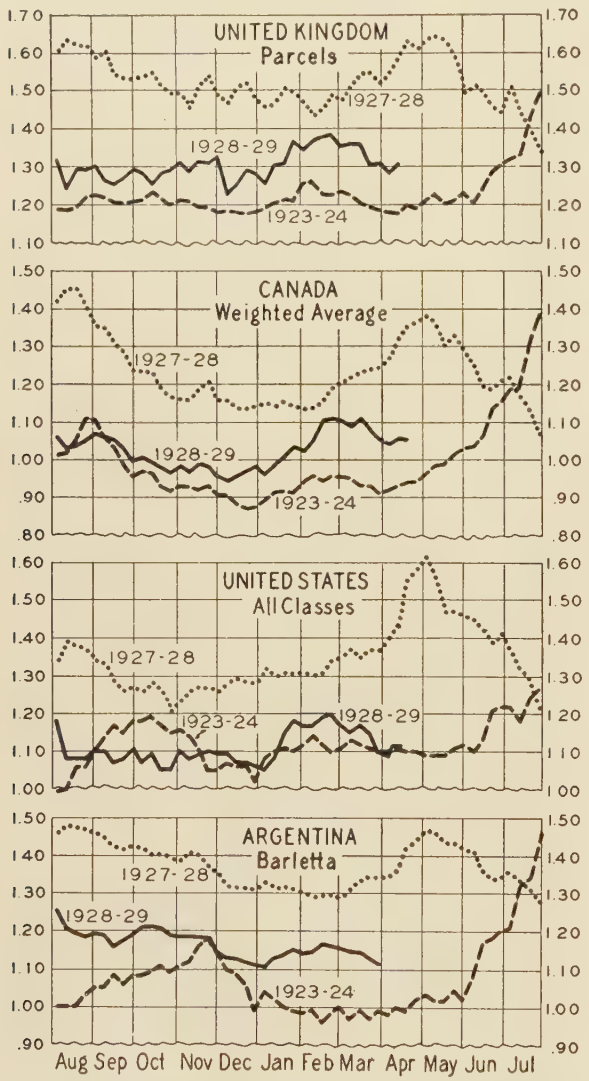
[1] See Wheat Studies, March 1929, V, No. 5, for a description of the methods by which we have computed weighted average cash prices at Winnipeg.

[2] Monthly averages of domestic wheat prices in England, France, Italy, and Germany are shown in Appendix Table IX.

1927–28. French prices also were no lower this year than last despite lower international prices. Poorer quality in 1927–28 is a partial explanation; an increase in the tariff is another. Italian prices were only a trifle lower this year, despite a much larger crop; here also an increase in the tariff duty was influential. In Germany, however, wheat prices were noticeably lower this year. There has been no change in the tariff, and domestic crops of both wheat and rye were much larger this year than last.

CHART 3.—WEEKLY AVERAGE PRICES OF WHEAT IN LEADING EXPORTING AND IMPORTING MARKETS, 1923–24, AND FROM AUGUST 1927*

(U.S. dollars per bushel)



* United Kingdom prices are averages of sales of wheat parcels in British markets, from *London Grain, Seed and Oil Reporter;* Canadian prices are weighted averages of different grades of wheat at Winnipeg (see WHEAT STUDIES, March 1929, V, No. 5); United States prices are weighted averages of all classes and grades of wheat in six markets (five markets in 1923–24), from *Crops and Markets;* Argentine prices are Friday quotations from *International Crop Report and Agricultural Statistics,* for 1923–24, and averages of daily prices from *Revista Semanal* from August 1927.

In Hungary a curious situation seems to prevail. Cash wheat prices during January–March at least were some 30 cents per bushel lower than they were a year ago; this difference is considerably greater than in the major exporting countries and on international markets, and makes Hungarian wheat look relatively cheap. Yet, in spite of a much larger crop Hungary has not been able to export as much wheat this year as last. Perhaps the explanation is that neighboring countries, with large domestic crops of their own, have required less, and have chosen to import Canadian wheat as better suited than Hungarian for mixing, in so far as they have imported at all.

THE COURSE OF PRICES

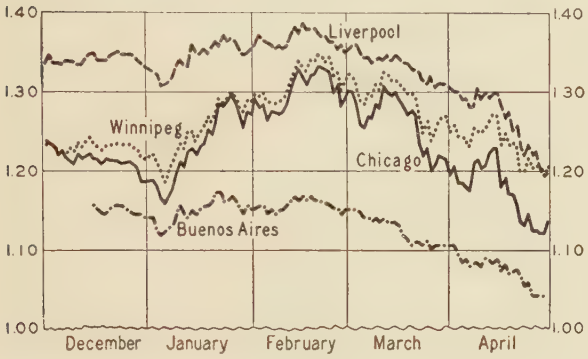
In somewhat the same way as the level of wheat prices usually shows changes of different magnitude in some markets from what occurs in others, the course of prices over a period of a few months may often be different in one market or in one grade of wheat from what it was in another market or in another grade. The relative movements of prices of all grades and varieties in all markets is of course scarcely susceptible of precise description. Charts 3 and 4, and Chart 5 (p. 226) together suffice to show how diverse the movement of prices has proved to be in December–April of the current year. The outstanding feature was the much greater stability of prices in the United Kingdom and Argentina than in the United States and Canada.

A significant summary view of the movement of prices in December–April is shown in Chart 4, which gives daily closing prices of May futures at Liverpool, Winnipeg, Chicago, and Buenos Aires. Fluctuations were small in all markets during the early weeks of December, but a sharp decline occurred between December 29 and January 5. The

movement was upward during the three ensuing weeks, but much more sharply in Chicago and Winnipeg than in Liverpool and Buenos Aires; the upward movement was continued (with interruptions, and not in Buenos Aires) until February 15 in Liverpool, and February 20 in Winnipeg and Chicago. The advance between January 5 and February 15–20 amounted to 17 cents

CHART 4.—DAILY CLOSING PRICES OF MAY WHEAT FUTURES IN FOUR LEADING MARKETS, DECEMBER–APRIL 1928–29*

(*U.S. dollars per bushel*)



* Data from *Chicago Journal of Commerce* and *Daily Trade Bulletin*, Chicago.

in Chicago, 16 cents in Winnipeg, but only 8 cents in Liverpool; in Buenos Aires, between the low point of January 4 and the high one of January 21/22, the advance was only 5½ cents. From the high points reached around February 15–20, futures prices declined up to the end of April, though there was a noticeable upturn in Chicago and Winnipeg during March 5–12, and another during April 6–15. The decline from mid-February to the end of April was greater than the earlier advance; it amounted to 21 cents in Chicago, 15 cents in Winnipeg, 19½ cents in Liverpool, and 12½ cents in Buenos Aires. Further declines occurred in the first week of May; and futures prices in all four markets stood on May 7–10 at the lowest point thus far in the crop year.

The sharp decline of late December and early January appears to have resulted chiefly from private estimates of a huge crop in Argentina, together with considerable pressure of offers of old-crop Argentine wheat on import markets at the holiday season, when demand was inactive.

The subsequent advance, so far as one can judge from statistical evidence and opinions voiced in the trade press, was due to a variety of factors, some of them decidedly intangible. It was made in the face of continuing ease in the international statistical position, though journals occasionally laid stress upon what was regarded as evidence of unexpectedly heavy consumption of wheat throughout the world. The evidence of heavy consumption may have encouraged many purchasers of futures to bid, and sellers to ask, higher prices than they would have done in its absence, and thus may have been a factor in raising prices; but in our judgment this factor might more reasonably have been regarded as one whose influence was confined to preventing further declines. Again, the Canadian Pool restricted offers for a time after January 5; and firmness in the prices of corn, enhanced by dry weather in Argentina, perhaps gave some support to the prices of wheat.

On the whole, however, the advancing prices of January and the first half of February seem attributable more largely to prospects of one kind or another, imagined or actual, than to actual changes in existing world supplies and requirements. Sellers of wheat received encouragement from the extremely cold weather (with alternations of freezing and thawing in parts of the United States) throughout the Northern Hemisphere, and from the abnormally dry winter in Canada. These developments contributed to a notion already widespread that wheat crops in 1929 must prove considerably smaller than those of 1928, if only because yield per acre in 1928 had been exceptionally large in most of the great wheat-producing countries. In the United States at least, many "longs" may have been encouraged by expectations that domestic wheat prices would be raised through legislation for farm relief apparently to be passed during a special session of Congress convened in April. The several factors resulted in a sharp increase in the volume of futures trading in the United States; the average daily volume in January was 41.7 million bushels as against 21.5 million in December 1928, 15.4 and 28.2 million in January 1928 and 1927 respectively. In

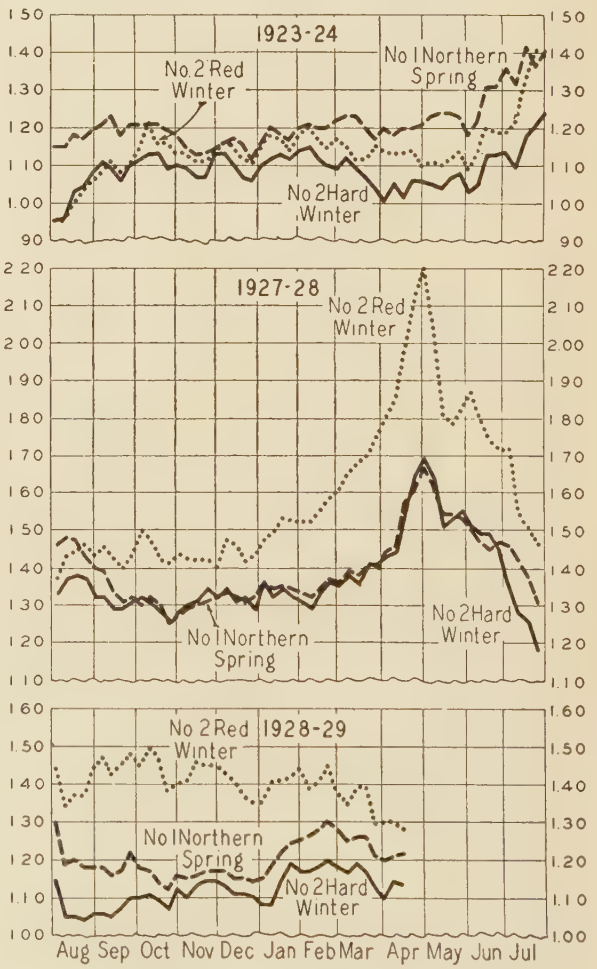
some respects the advance was similar to those which occurred in February–April 1928 and in April–May 1927; but this year the advance was based upon considerably less tangible evidence respecting the new-crop outlook.

The fact that prices rose more rapidly in Chicago than in Winnipeg, in Winnipeg than in Liverpool, and in Liverpool than in Buenos Aires is broadly explicable on several grounds. American traders naturally were more concerned than others with farm relief legislation. Evidence of possible damage to the oncoming winter-wheat crop seemed more convincing in the United States than elsewhere, and naturally exerted more influence in Chicago than in foreign markets remote from the territory concerned. The markets in Liverpool and Buenos Aires, always largely influenced at this season by the actual movement of the new Argentine crop, could hardly be expected to respond in full to price movements in North America which were based, apparently to an unusual degree, upon somewhat intangible hopes, fears, and expectations.

A considerable part of the decline from mid-February to the end of April may be taken to represent the gradual reversal of these intangible hopes, fears, or expectations. Toward the end of February and in early March, Argentina shipped exceptional quantities of wheat, much of which was unsold and pressed all the more heavily upon European markets because heavy port stocks had already accumulated on account of the frozen inland waterways. Milder temperatures, with accompanying disappearance of snow and renewal of the growth of winter wheat, resulted in an accumulation of evidence tending to show that winterkilling promised to prove less extensive than had been hoped (or feared) either in the United States or in Europe. Hopes that American wheat prices during the present crop year would be raised by legislation were apparently dampened when proposals to introduce the "debenture plan" into the Senate bill threatened to delay legislation indefinitely. A new factor which appears to have contributed to a sharp break in Chicago prices on March 26 was a break in the stock market, accompanied by exceedingly high call money rates. Under all these developments, prices fell to a level more in accord with the existing ease in the international statistical position. If, as seems probable, the actual change in the statistical position was such as to make it only slightly easier in April than it was in December, a part of the decline in prices may have been due to the fact that new-crop prospects seemed favorable enough to suggest the possibility of a still easier position in 1929–30. It is always impossible, of course, precisely to separate the effects of

CHART 5.—WEEKLY AVERAGE CASH PRICES OF TYPICAL WHEATS IN UNITED STATES MARKETS, 1923–24, AND FROM AUGUST 1927*

(U.S. dollars per bushel)



* No. 2 Red Winter at St. Louis, No. 2 Hard Winter at Kansas City, and No. 1 Northern Spring at Minneapolis. Data from *Crops and Markets*.

changes in the cash wheat situation from the effects of changes in the outlook for new crops. The less rapid decline of the May future in Winnipeg than in Chicago and Liverpool was perhaps due to the fact that the outlook for new crops remained more precarious in Canada than in the United States or Europe; but in part it may have represented merely a normal seasonal movement.

The prices of other futures than the May in the several markets are not shown in Chart 4. This year, however, as a result of the exceedingly heavy visible supplies, near futures have stood at exceptionally heavy discounts under the distant. In Chicago, Winnipeg, and Liverpool alike the more distant futures (October or September) have stood above the July, the July above the May, the May above the March. Ordinarily no carrying charge exists between the May future (old-crop) and the September or October (new-crop). During the period 1900–28 (excluding 1915–21), the July and September futures were quoted in May at a premium over the May future in only four years. The premiums were never so large as they have been thus far in May 1929.

United States Cash Prices

Chart 5 (opposite) shows weighted average cash prices of representative grades of wheat in the United States. The outstanding development during December–April was the reduction of the premium of No. 2 Red Winter over No. 1 Northern Spring or No. 2 Hard Winter. Last year during the same period the premium was increasing rapidly, principally because the outlook was increasingly unfavorable for the soft red winter-wheat crop of 1928. A decidedly small crop was harvested, and premiums remained high in the first half of 1928–29. Since December 1928, however, the outlook for the winter-wheat crop of 1929 has proved relatively more favorable in the soft red winter-wheat belt than in the hard red winter-wheat belt, and partly for this reason No. 2 Red Winter has sold at smaller premiums. Another factor, however, was the fact that the hard red winter-wheat crop of 1928 contained a considerable proportion of bleached wheat relatively low in protein content; this wheat, like yellow hard winter wheat, seems to have been employed in increasing quantities by millers to replace the higher-priced soft red winter wheat.

V. PROSPECTS FOR 1929 CROPS

At this season the prospects for the oncoming world wheat crop are highly uncertain, and the present year is no exception. Of Southern Hemisphere winter-wheat crops which are not yet planted in full, no more can be said than that acreage is tending upward, and that a recurrence in 1929 of the huge crops of 1928 both in Argentina and Australia is statistically improbable, though by no means impossible. Little can be foreseen respecting the size of the spring-wheat crops in the United States and Canada; here also acreage has tended upward, though the trend may be interrupted in the United States at least. The seeding of spring wheat is not yet complete, and much depends upon rainfall in June and July especially; an average yield per acre is now the most reasonable expectation. If yield prove no greater than average, spring-wheat crops smaller than those of 1928 will be harvested.

Acreage sown, abandonment, and spring condition of winter-wheat crops in the Northern Hemisphere are fairly clear. The acreage to be harvested now seems larger than in 1928 in both Europe and the United States; since condition is not far from average, a small crop is improbable, a good crop probable, a large one possible. But that the European winter-wheat crop of 1929 should exceed the crop of 1928 seems somewhat unlikely because a repetition of the extraordinarily favorable late growing season last year cannot be counted upon. The winter-wheat crop of the United States, however, may equal that of 1928. India seems assured of a small crop, though larger than the poor one of 1928; and northern Africa promises to secure about as good a crop as that of 1928. All told, the statistical expectation at the moment is for a total Northern Hemisphere crop of winter and spring wheat (excluding China, Russia,

and Asia Minor) smaller than that of 1928, but not small by comparison with most earlier years because of enlargement in acreage. Much the same may be said of the probable world crop excluding Russia, China, and Asia Minor. But statistical expectations are often proved faulty. In May 1928, for example, these suggested that a smaller Northern Hemisphere crop was in prospect than had been harvested in 1927, but the crop of 1928 proved the larger by over 150 million bushels.

India and North Africa

The Indian wheat crop of 1929, the earliest to be harvested in the Northern Hemisphere, now appears to be another short one, 308 million bushels according to the first official estimate issued on April 25. Unless later estimates raise the figure, this is the third smallest outturn in a decade. In 1920 and 1922–24 the Indian crops ranged from 361 to 378 million bushels; in 1925–27, from 325 to 335 million; in 1921 the crop was only 250 million, and in 1928 it was 289 million. This year the outlook turned unfavorable in January and February; winter rains were scanty, and some damage was caused by exceptionally cold weather.

The crops of Algeria, Morocco, Tunis, and Egypt are less far advanced. The area sown for the crop of 1929 in the first three dependencies was half a million acres larger than the area harvested in 1928. Crop conditions appear to have been rather more favorable than usual throughout northern Africa; rainfall has been ample, though low temperatures somewhat retarded development of the plant. Outturns average or above, and perhaps not far different from those of 1928, now seem in prospect.

Europe, including Russia

So far as may be judged from preliminary official estimates and from unofficial advices, the area sown to winter wheat in Europe (ex-Russia) in 1929 seems to have continued its upward trend. According to data published by the United States Department of Agriculture on April 29, the area sown in 11 European countries for the crop of 1929 was 56.15 million acres as against 55.34 million sown for the crop of 1928. The list included Spain, France, Italy, Jugo-Slavia, Roumania, Bulgaria, Poland, and Czecho-Slovakia, so that the only large wheat-producing countries not included were Hungary, Germany, and the British Isles. The principal increases in areas sown occurred in Spain and Jugo-Slavia. Unofficial reports suggest that the areas sown for the crop of 1929 in countries not included in the list were no smaller than those sown for the crop of 1928, and were probably somewhat larger. Hence, so far as acreage sown to winter wheat alone determines European (ex-Russian) production, the European crop of 1929 promises to exceed even that of 1928.

Areas abandoned need also to be considered, and of this factor little is known as yet. Extraordinarily cold weather prevailed practically throughout Europe from the first week of January to the first week of March, though conditions naturally differed somewhat from country to country, and there were spells of milder weather, especially in mid-February. The snows were heavy, disturbing traffic by rail; and inland waterways normally open to traffic, especially in Belgium, Holland, and Germany, were frozen and closed to traffic for about a month. The Rhine was reopened only on March 15. During most of the period of extreme cold, the snow cover appears to have been good; nevertheless the very intensity of cold gave rise to fears that an abnormal amount of winterkilling was almost inevitable. More extensive damage was feared in parts of the Danube countries and in France than elsewhere; here the snow cover seemed less satisfactory. But normal spring weather prevailed in March; and as the snow cover disappeared and wheat resumed its growth, evidence of abnormal winterkilling failed to appear in most countries. The situation is not yet clear, partly because the weather turned unseasonably cold in April and retarded the growth which would make clearer the effects of the winter. But so far as can be judged from official and unofficial advices, only the normal amount of winterkilling occurred in the principal wheat-producing countries of Europe, parts of the Danube countries excepted. Precise comparisons are impossible; the normal amount is not known. Nevertheless, the prospects are for a good

wheat crop in Europe in 1929 not only because the area sown was large, but also because abandonment was not exceptional.

Again, condition as of April 1 appears to have been average or above in most countries, though reports are scattered and fragmentary. At least there were no reports of distinctly bad condition in any important wheat-producing region. The effects of the unseasonably cold weather of early April are not yet clear, but trade reports suggest some deterioration. All told, the evidence now available suggests a European wheat crop in 1929 of average size or larger—certainly not a small one. But the critical period of growth remains to be encountered. Frost, drought, or abnormally wet weather in May–July may reverse the present outlook; favorable weather may improve it distinctly. It is worth while to point out, however, that the largest European crops of recent years, those of 1925 and 1928, were characterized by exceptionally favorable weather in the latter part of the growing season. On general statistical principles it is reasonable to expect that the abnormally high yields per acre obtained in many European countries in these two years will not be recorded in 1929. On the other hand, the high acreage and normal abandonment in 1929 create the presumption that crops as small as those of 1922 and 1924 (1,038 and 1,050 million bushels respectively) are unlikely. A reasonable forecast of the European crop of 1929 made on the basis of information now available is perhaps 1,200 to 1,350 million bushels, a wide range; but any prediction must rest upon uncertain grounds, and may easily prove widely in error if unpredictable weather conditions prove in any way distinctly unusual. The most that can be said at present is that the statistical probabilities favor a crop average or better in size, but not so large as the crop of 1928. A further probability is that the importing countries of Europe will have crops in the aggregate more nearly similar in size to those of 1928 than will be true in the Danube countries; for the crop of 1928 was more unusual with respect to yield per acre in the Danube countries than elsewhere in Europe, and it is in these countries that the severe winter appears to have caused the most damage.

Little can be said of the outlook in Russia. Sowings of winter wheat for the crop of 1929 appear to have been considerably smaller than the sowings for 1928 or 1927.[1] Russia, however, produces more spring than winter wheat, and an increase in the area sown to spring could repair this loss. Whether or not this will occur is not clear; but most observers are skeptical of the possibility because the spring is late and because the wealthier peasants seem to express their grievances against the government by curtailing the areas sown to grain. Estimates now available on production and acreage of wheat in 1928 (both of which may be subject to revision) indicate that yield per acre in 1928 was the highest of the past six years; and if total acreage proves considerably smaller this year than last, production may prove smaller also on the assumption that a second year of exceptional yield per acre is improbable.

United States Winter Wheat

The area sown to winter wheat last autumn was officially estimated (subject to later revisions) at 43.2 million acres, smaller than the areas sown for the crops of 1919–23, larger than the areas sown for the crops of 1924–26, and fully 4.1 million acres smaller than the sowings for the crop of 1928. All of the principal wheat-producing states sowed smaller areas for 1929 than for 1928; but the reduction was most noticeable in the soft red winter-wheat belt where the crop of 1928 was so short. Illinois, Indiana, and Ohio sowed an area 1.82 million acres smaller this year than last.

The crop entered the winter under average condition—84.4 per cent of normal on December 1 as compared with the 1918–27 average condition of 84.6 per cent. Toward the end of December there was some alternation of freezing and thawing weather in Indiana and Illinois. A severe cold wave prevailed during the first two weeks of January, but snow cover was good except in northwestern Kansas and east of Illinois. For three weeks following the weather was mostly unfavorable; snow cover largely melted, and ice formed over the wheat

[1] See *Foreign Crops and Markets*, April 22 and 29, 1929, XVIII, 551, 574.

fields in parts of Illinois, Indiana, and Missouri. February, like January, was an abnormally cold month, but snow preceded the sharpest weather in most of the important wheat-growing sections. Despite the good snow cover and the moderate tone of official and many unofficial weather reports, the cold weather of these two months apparently caused many to believe that abandonment must prove distinctly heavy. March was abnormally warm; and as the wheat plant resumed its growth, little evidence of unusual damage became apparent. There was abundant moisture except in western Kansas, southern Nebraska, and the Pacific Northwest.

On April 9, condition as of April 1 was officially placed at 82.7 per cent of normal, as compared with a 1919–28 average of 80.9 per cent on April 1. At the same time in 1928, condition was only 68.8 per cent of normal. The official report further suggested that abandoned acreage seemed likely to fall below the ten-year average of about 12 per cent, and might be expected to approximate only 7 per cent. Private statisticians, in estimates issued earlier in the month, had given broadly similar pictures of the situation with respect to condition and abandonment; their forecasts of production ranged from 534 to 580 million bushels, and suggested a crop about average in size. Of the 9 winter-wheat crops harvested since 1920, only one (that of 1925) has fallen below this range; only three (those of 1920, 1921, and 1926) appreciably above it.

In April also weather conditions were favorable, especially because good rains fell in the portions of Kansas and Nebraska where moisture was most needed. Unofficial reports issued on May 1 reflected improved prospects. Estimates of abandonment of winter-wheat area (4 reports) ranged from 6.3 to 7.6 per cent; of area remaining for harvest (5 reports) from 39.94 to 40.92 million acres; of condition (5 reports) from 83.2 to 89.7 per cent; and of probable production (5 reports) from 599 to 646 million bushels. The official report issued May 9 confirmed this picture of low abandonment, high acreage and good condition, and large probable outturn. Abandonment was placed at 6.4 per cent; acreage at 40.47 million acres; condition at 83.6 per cent; and probable outturn at 595 million bushels.

During the preceding nine years, the final estimate of production fell farthest below the May 1 forecast by about 10 per cent, in 1925. If deterioration proves as great this year, a crop of some 535 million bushels is still in prospect—a fair crop; and if conditions improve as in 1926 and 1928, a bumper crop will be harvested. The outlook at the moment is for a large crop, especially of soft red winter wheat; a distinctly short crop is decidedly improbable. Frost was reported over a considerable area in the Southwest on the night of May 1, but no complaints of serious damage appeared in the following week.

North American Spring Wheat

The outlook for spring-wheat crops in the United States and Canada is of course more uncertain, since in some districts seeding is not yet completed, while total acreage sown is uncertain, and in most districts the plant has hardly begun its growth.

In the United States, farmers expressed on March 1 intentions to plant some 21,463 thousand acres to spring wheat in 1929, an area only 82,000 acres smaller than was harvested in 1928. A reduction of 1.3 million acres in durum wheat was to be offset by increased sowings of bread wheat. Weather conditions seem to have been favorable for the fulfilment of plans, though there was some delay in mid-April owing to rain and snow. Subsoil and surface moisture conditions alike are said to be satisfactory. The declining prices of March–April, however, may have tended to curtail the area sown.

In the Prairie Provinces of Canada, only about half of the normal supply of moisture appears to have fallen up to the end of March. There were good rains in April, however. Seeding began at a normal date, with more land prepared for crops in the fall than was true last year; subsequently it progressed favorably, but it is not yet completed. Recent advices suggest that acreage bids fair to exceed that of 1928; Murray's report of May 1, based on returns from correspondents, placed the probable increase at 5.6 per cent. Reserves of mois-

ture in many regions are said to be short, so that rainfall in June and July, always important in its effects upon yield, may be of unusual importance this year.

VI. OUTLOOK FOR TRADE, PRICES, AND CARRYOVERS

Wheat price movements during the three closing months of the crop year 1928–29 may be expected, as usual at this season, to depend chiefly upon changing prospects for the oncoming wheat crops, and in turn to affect the movement of wheat in international trade and the magnitude of carryovers in different positions at the end of the crop year. Nevertheless, since the physical movement of wheat always displays certain seasonal characteristics which are modified but not reversed by price movements, the outlook for trade during the closing months of the year and for outward carryovers may be set forth with more assurance than the outlook for prices.

The Price Outlook

The price outlook is always obscure. If normal weather prevails, international cash wheat prices, as judged by the British parcels prices, may reasonably be expected to lie fairly close to the level prevailing in the first third of May. The expectation, as usual, is for normal temperature and rainfall in the Northern Hemisphere as a whole, not for extreme heat, drought, frost, hail, rainfall, or damage from plant diseases, and also not for an exceptionally favorable growing season. In 1924, British parcels prices rose over 30 cents during May–July; in 1928, they declined over 30 cents during May–July. Such extreme movements are improbable, but of course not impossible, this year. The growing season in 1924 was one properly to be described as distinctly unfavorable; winterkilling had been heavy and areas sown to spring wheat had been considerably reduced, as is not the case this year; and stocks, though large, were smaller than those of 1929. Seemingly only an even more unfavorable growing season would need to supervene if British parcels prices are to be increased by 30 cents this year; and, though it may occur, there is at present no reason to regard its occurrence as probable. Similarly, the May–July decline in 1928 was fundamentally due to extraordinarily favorable growing weather; and, though there may be another such season in 1929, its occurrence is hardly to be regarded as probable. Between these extremes, the price movement may be in either direction. But the existing heavy stocks will continue to act as a drag upon any upward movement. Whatever the movement of international cash prices, the movements of particular grades of wheat and of prices in particular countries may be expected to be more or less different. Winter wheat may progress favorably, spring wheat poorly; Europe may enjoy favorable weather while the United States does not, or the reverse. The possibilities hardly bear enumeration, much less evaluation with reference to their possible or probable effect on price relationships.

International Trade

We have already considered certain aspects of the outlook for international trade.[1] Despite her heavy stocks, the United States may now hardly be expected to furnish net exports of much more than 25 million bushels in April–June, for prices apparently remain out of line with import markets at least to the date of writing (May 10). July exports, however, may prove fairly large if the winter-wheat crop in Texas and Oklahoma proves to be of good size and fair quality and is not harvested late. Canada has more wheat to export even than she had in 1928, when record exports of 106 million bushels were made in April–July, and she may export more than this unless the carryover is built up still higher than it was on July 31, 1928, as now seems improbable; net exports in April and May may considerably exceed those of April and May 1928, while exports in June and July may prove little if any larger.[2] Argentina

[1] See above, pp. 212–14.

[2] Recent reports of congestion at Montreal, with wheat moving into the port rapidly and vessels apparently not chartered to transport it overseas in equivalent volume, suggest that this statement requires qualification. It is impossible to foresee, however, whether this congestion is to be of short or of long duration.

bids fair to export a record quantity in April–July from supplies apparently the largest in history; and the seasonal decline may be less marked this year than last because the requirements for tonnage to move corn will be smaller. Australia also may ship fairly large quantities in view of her large stocks, though perhaps not so much as in 1925 and 1927, when available supplies were of much the same size, but prices were higher. Railway freight rates on wheat destined for export were recently reduced from Missouri and Mississippi points to the Gulf and Atlantic seaboard, and from lake ports to seaboard. These reductions were met in Canada by reductions in the rates to Montreal, so that the net effect is probably not to encourage United States exports at the expense of Canadian. Unless the total rates from Argentina and Australia are reduced to meet the lower charges from North America, these changes may tend to encourage shipments from North America at the expense of shipments from the Southern Hemisphere.

The probable shipments from these four countries alone are sufficiently large to warrant the inference that the volume of international trade in April–July promises to be of large size for these months though probably not so large as in April–July 1927. India cannot be expected to furnish appreciable quantities because her new crop is small; as late as mid-April, indeed, further purchases were made of Australian wheat. Russia cannot be expected to become a net exporter, and indeed may possibly import, though expectations that imports would be made have been disappointed thus far in the year. Other countries, which in the first two-thirds of the crop year exported only moderate quantities in view of the wheat supplies available, seem unlikely to become heavy shippers. Even if heavy shipments are made from the major exporting countries, year-end stocks promise to be of record size. Among the importing countries, the United Kingdom especially will probably take exceptional quantities for the season.

Financial conditions in Europe are at present in a somewhat disturbed status. The high rate for call money in the United States and the present position of the American rediscount rate have had the effect of checking American credits to Europe, resulting in higher rediscount rates in European countries, with a tendency in the direction of export of gold to the United States. Such monetary developments are likely to have some influence on movements of goods in international commerce, and it is possible that trade in wheat in the near future may be somewhat affected.

Outward Carryovers

Estimates of outward carryovers must always rest, at this season, upon assumptions respecting old and new crops, exports, and domestic utilization of wheat in various countries. Appendix Table XI shows our present estimates of wheat supplies and disposition in the four major exporting countries; probable carryovers constitute one of the items of disposition there shown.

The carryover in the United States may be estimated upon a somewhat more satisfactory basis than is possible for other countries. The total comprising visible supplies (Bradstreet's), farm stocks, country mill and elevator stocks, and stocks held by city mills, may be expected to range somewhere between 195 and 240 million bushels on June 30, 1929. During the past three years, the period for which data are available, city mill stocks[1] have declined about 55 million bushels between December 31 and June 30, and about 30 million bushels between March 31 and June 30. This year city mill stocks stood at the high figures of 138 and 107 million bushels on December 31 and March 31 respectively; and if normal reductions occur, stocks of around 80 million bushels are probable on June 30. If the total of visible supplies, farm stocks, and country mill and elevator stocks on March 1, some 357 million bushels, declines as has occurred on the average in 1920–28, about 115 million bushels would remain on June 30, 1929, making a total of about 195 million bushels. But on other bases of estimation this total seems too low if the several components of the carryover are considered separately. If visible supplies de-

[1] Calculated to exclude mill stocks in country elevators and in public terminal elevators, in order to avoid duplication with estimates of visible supplies and country mill and elevator stocks.

cline from their end-March level even at the most rapid rate in the past five years, they must still stand at about 95 million bushels on June 30; and if one counts upon farm and country mill and elevator stocks reaching the lowest in the past nine years, these items together must reach about 45 million bushels, a distinctly low figure. On this basis the total carryover seems likely to approximate at least 220 million bushels, probably more. A decline in American wheat prices relative to international prices might permit additional exports which would reduce visible supplies and cause the carryover to be smaller than this, but not much smaller because such a price adjustment has now (May 10) less than two months in which to achieve its effect. A figure of 220 million bushels for the outward carryover in the United States is extremely high by comparison with earlier years. Nevertheless the final returns seem quite as likely to prove higher as to prove lower.

Over the period 1922–28, Canadian carryovers on July 31 have constituted from 20 to 34 per cent of the stocks existing on March 31. On this basis, one may expect the carryover on July 31, 1929, to range anywhere between 50 and 83 million bushels, higher than in any earlier year except 1928, when stocks of 75 million bushels remained in Canada on July 31. In our judgment a carryover as low as 50 million bushels is improbable: the low level of prices can hardly have encouraged exceptional efforts to make heavy forward sales for export; and there is probably an upward trend in carryovers due in part to growth of storage space. On the other hand, a rate of reduction of March 31 stocks as slow as that which occurred last year seems somewhat unlikely. Prospects of obtaining higher prices toward the end of the year have been considerably less bright in March–April this year than last. We therefore anticipate that the carryover on July 31 will constitute about the average proportion of stocks on March 31, say 26 per cent, or 65 million bushels in rounded figures. The actual carryover may well prove 5–10 million bushels more or less than this, probably more rather than less. Size of crop considered, 65 million bushels is not an exceptionally large Canadian carryover; but it would exceed any other carryover except that of 1928 by more than 15 million bushels. If the carryover approximates 65 million, and if our estimates of other items of disposition prove close to the facts, the standing Canadian crop estimate for 1928 would seem to be at least 15 million bushels too low.

Argentine and Australian year-end stocks can be estimated only as residual items in disposition. For Argentina, our estimates of net exports and domestic utilization for 1928–29 subtracted from available supplies suggest a figure of 64 million bushels for year-end stocks. In the preceding five years Argentine year-end stocks have ranged, so far as we are able to ascertain, from about 55 to 70 million bushels. Hence our figure for 1929 seems about an average one; but it looks somewhat too low in view of the high stocks (70 million bushels) of 1928, the huge crop, and the low level of prices. If stocks on August 1, 1929, considerably exceed 64 million bushels, and if net exports for the crop year reach or exceed 215 million bushels, there will be reason to suppose that the crop of 1928 was larger than 300 million bushels.

Similar calculations for Australia suggest year-end stocks of only 34 million bushels, a figure which appears somewhat low in view of the large crop and low level of prices. The Australian crop of 1928, however, may exceed 159 million bushels;[1] and, if so, and if our estimates of net exports, seed requirements, food, and feed prove correct, year-end stocks calculated as the residual item in disposition would exceed 34 million bushels.

All told, stocks in the four principal exporting countries now seem likely to exceed 380 million bushels at the end of the crop year. Last year, when such stocks were previously the largest of post-war years, the total fell below 330 million. Hence the present crop year promises to end, as it has proved throughout its course, a year of extraordinarily heavy accumulations of wheat stocks in the major exporting countries.

The outlook for year-end stocks in the minor exporting countries and in importing

[1] See above, p. 209.

countries is far less clear, in the absence of statistical information. There can be little doubt, however, that carryovers will prove of exceptional size in the aggregate. Europe ex-Russia as a whole harvested larger wheat crops in 1928 than in 1927, and bids fair to import more wheat in 1928–29 than in 1927–28. One cannot at present determine whether or not actual consumption, under the stimulus of low wheat prices and a short crop of corn, may have increased so greatly as to exceed the increase in crop and imports of wheat. But this seems improbable, and on the whole one is justified in assuming that European stocks, and presumably ex-European as well, will stand higher at the end than at the beginning of the year 1928–29. If so, world stocks are likely to prove of record size for post-war years; but the situation must differ greatly from country to country. The upbuilding of stocks in 1928–29 now promises to appear more striking in the United States than elsewhere.

This study is the work of M. K. Bennett, with the advice of Joseph S. Davis and Alonzo E. Taylor, and with the aid of Katherine Merriam and Janet Murray. The Institute is indebted to Mr. P. C. Rutherford, of Minneapolis, for information on the situation in the United States spring-wheat belt.

APPENDIX

TABLE I.—WHEAT PRODUCTION IN PRINCIPAL PRODUCING AREAS, 1920–28*

(Million bushels)

Year	United States	Canada	India	Australia	Argentina	Chile	Uruguay	Hungary	Bulgaria	Jugo-Slavia	Roumania	Soviet Russia	Mexico
1920.....	833.0	263.2	377.9	145.9	156.1	23.2	7.8	37.9	29.9	43.0	61.3	.....	15.0
1921.....	814.9	300.9	250.4	129.1	191.0	23.6	10.0	52.7	29.2	51.8	78.6	.....	5.1
1922.....	867.6	399.8	367.0	109.5	195.8	25.9	5.2	54.7	32.6	44.5	92.0	.....	13.6
1923.....	797.4	474.2	372.4	125.0	247.8	28.1	13.3	67.7	29.1	61.1	102.1	419.1	13.7
1924.....	864.4	262.1	360.6	164.6	191.1	24.5	9.9	51.6	24.7	57.8	70.4	472.3	10.4
1925.....	676.4	395.5	331.0	114.5	191.1	26.7	10.0	71.7	41.4	78.6	104.7	729.9	9.2
1926.....	831.0	407.1	324.7	160.8	220.8	23.3	10.2	74.9	36.5	71.4	110.9	819.6	10.3
1927.....	878.4	479.7	335.0	116.7	239.2	33.5	15.4	76.9	47.3	56.6	96.7	749.0	11.9
1928.....	902.7	533.5	288.8	159.0	.....	....	15.2	92.0	50.7	96.4	115.6	859.8	11.3
Average													
1909–13.....	690.1	197.1	351.8	90.5	147.1	20.1	6.5[a]	71.5	37.8	62.0	158.7[a]	758.9[b]	11.5[a]
1923–27.....	809.5	403.7	344.7	136.3	218.0	27.2	11.5	68.6	35.8	65.1	97.0	638.0	11.1

Year	Morocco	Algeria	Tunis	Egypt	British Isles	France	Germany	Italy	Belgium	Netherlands	Denmark	Norway	Sweden
1920.....	17.9	16.2	5.2	31.7	56.8	236.9	82.6	141.3	10.3	6.0	7.4	1.00	10.3
1921.....	23.2	28.5	9.0	37.0	73.8	323.5	107.8	194.1	14.5	8.6	11.1	.97	12.3
1922.....	12.9	18.9	3.7	36.0	65.2	243.3	71.9	161.6	10.6	6.2	9.2	.64	9.5
1923.....	20.0	35.8	9.9	40.7	58.5	275.6	106.4	224.8	13.4	6.2	8.9	.59	11.0
1924.....	28.8	17.3	5.2	34.2	53.9	281.2	89.2	170.1	13.0	4.7	5.9	.49	6.8
1925.....	23.9	32.7	11.8	36.2	53.7	330.8	118.2	240.8	14.5	5.6	9.7	.49	13.4
1926.....	16.2	23.6	13.0	37.2	52.2	231.8	95.4	220.6	12.8	5.5	8.8	.59	12.2
1927.....	24.6	28.3	8.3	44.3	57.2	276.1	120.5	195.8	16.3	6.2	9.4	.60	11.3
1928.....	22.2	31.4	12.1	37.3	51.2	277.7	141.6	228.6	17.8	7.6	12.1	.68	19.5
Average													
1909–13.....	17.0	35.2	6.2	34.2	59.6	325.6	131.3	184.4	15.2	5.0	6.3	.31	8.1
1923–27.....	22.7	27.5	9.6	38.5	55.1	279.1	106.0	210.5	14.0	5.6	8.5	.55	10.9

Year	Spain	Portugal	Switzerland	Austria	Czecho-Slovakia	Poland	Finland	Latvia	Esthonia Lithuania	Greece	Japan, Chosen	South Africa	New Zealand
1920.....	138.6	10.4	3.6	5.4	26.4	22.7	.27	.39	2.58	11.2	41.1	7.6	6.9
1921.....	145.1	9.3	3.8	6.5	38.7	37.4	.58	.78	3.34	10.3	39.7	8.7	10.6
1922.....	125.5	10.0	2.6	7.4	33.6	42.4	.71	.96	4.17	9.0	39.8	6.3	8.4
1923.....	157.1	13.2	3.8	8.9	36.2	49.7	.69	1.64	3.70	8.8	35.2	6.0	4.2
1924.....	121.8	8.6	3.1	8.5	32.2	32.5	.79	1.58	3.86	7.7	35.3	7.1	5.4
1925.....	162.6	12.1	3.5	10.7	39.3	57.8	.93	2.16	6.08	11.2	40.0	9.2	4.6
1926.....	146.6	8.6	4.2	9.4	34.1	47.1	.92	1.86	5.02	12.4	38.9	8.0	8.0
1927.....	144.8	11.4	4.1	12.0	40.4	54.2	1.06	2.64	6.35	13.0	40.4	6.6	9.5
1928.....	122.6	6.6	4.3	12.1	48.2	59.2	.88	2.50	7.36	15.7	41.6	6.9	...
Average													
1909–13.....	130.4	11.8[c]	3.3	12.8	37.9	63.7	.14	1.48	3.63	16.3[c]	32.0	6.3[a]	6.9
1923–27.....	146.6	10.8	3.8	9.9	36.5	48.3	.88	1.98	5.00	10.6	38.0	7.4	6.3

* Data of U.S. Department of Agriculture. For 1909–13, including U.S. Department of Agriculture estimates for area within post-war boundaries. Dots (...) indicate that data are not available.

[a] Four-year average.

[b] Regarded as too low by some Soviet officials, whose estimate is 908 million bushels.

[c] One year only.

TABLE II.—MONTHLY WHEAT RECEIPTS AT PRIMARY MARKETS IN THE UNITED STATES AND CANADA*

(*Million bushels*)

Month	United States primary markets				Fort William and Port Arthur				Vancouver			
	1925–26	1926–27	1927–28	1928–29	1925–26	1926–27	1927–28	1928–29	1925–26	1926–27	1927–28	1928–29
Aug.	43.3	71.6	81.6	84.2	1.2	1.5	2.4	3.5	.55	.12	.09	1.07
Sept.	57.9	48.7	79.7	73.3	45.7	32.8	8.6	39.1	.28	.29	.32	2.61
Oct.	36.1	37.1	73.3	84.4	53.2	56.1	51.4	81.4	7.04	6.37	6.17	12.69
Nov.	34.1	29.8	44.8	43.6	51.5	60.5	71.0	72.9	9.79	7.22	10.78	14.65
Aug.–Nov.	171.4	187.2	279.4	285.5	151.6	150.9	133.4	196.9	17.66	14.00	17.36	31.02
Dec.	34.9	22.4	26.5	33.0	53.5	26.3	41.0	51.6	6.14	6.63	11.81	13.53
Jan.	21.6	24.6	23.5	22.5	10.5	14.0	21.1	11.0	10.03	6.83	16.49	13.90
Feb.	16.2	21.0	22.5	28.7	4.0	8.6	9.5	2.9	7.74	4.27	12.54	9.25
Mar.	15.1	16.6	26.3	27.2	3.2	6.3	3.3	5.2	6.98	5.94	10.50	15.46
Dec.–Mar.	87.8	84.6	98.8	111.4	71.2	55.2	74.9	70.7	30.89	23.67	51.34	52.14
Apr.	14.0	14.4	18.0	....	1.8	12.6	.9	....	3.58	3.58	10.88	.....
May	15.7	19.2	25.9	....	17.2	17.3	17.6	....	1.20	1.56	7.43	.....
June	21.0	20.7	15.6	....	13.6	7.3	20.1	....	.22	.61	3.66	.....
July	77.0	58.8	72.6	....	6.4	10.7	14.4	....	.27	.14	2.44	.....
Apr.–July	127.7	113.1	132.1	....	39.0	47.9	53.0	....	5.27	5.89	24.41	.....
Aug.–July	386.9	384.9	510.3	....	261.8	254.0	261.3	....	53.82	43.56	93.11	.....

* United States data are unofficial figures compiled from *Survey of Current Business;* Canadian data are official figures from *Reports on the Grain Trade of Canada* and *Canadian Grain Statistics.* Vancouver figures include receipts at Prince Rupert after October 1, 1926.

TABLE III.—WEEKLY WHEAT RECEIPTS AT PRIMARY MARKETS IN THE UNITED STATES AND CANADA*

(*Million bushels*)

Month	United States				Fort William and Port Arthur				Vancouver			
	1925–26	1926–27	1927–28	1928–29	1925–26	1926–27	1927–28	1928–29	1925–26	1926–27[a]	1927–28[a]	1928–29[a]
Dec.	9.74	5.44	8.90	11.19	14.64	10.55	14.95	17.83	1.94	.95	2.57	2.44
	9.66	5.67	6.41	8.18	14.77	7.14	11.05	16.33	1.30	1.02	2.26	3.40
	8.64	4.91	5.81	8.92	14.56	4.99	9.60	15.36	.74	1.52	2.46	3.78
	6.18	3.98	5.11	7.84	8.82	3.87	8.62	8.98	2.15	1.86	3.08	2.99
Jan.	3.45	4.21	4.74	5.41	4.98	4.66	5.91	7.57	.60	1.76	2.75	2.57
	6.22	4.69	4.56	4.49	4.32	5.21	5.28	3.96	1.86	1.75	3.16	3.32
	5.23	4.76	4.96	4.51	2.73	3.71	6.20	2.91	1.99	1.76	3.18	2.48
	4.64	4.64	6.18	4.20	1.63	2.81	4.95	2.10	2.73	1.11	3.45	2.84
	4.39	5.26	5.96	5.71	1.31	1.98	3.55	1.77	2.78	1.76	4.98	3.41
Feb.	4.31	6.16	5.67	6.57	1.21	1.98	2.69	1.34	2.42	1.33	4.49	2.88
	4.06	4.96	5.67	6.50	1.09	2.27	2.97	.90	1.93	1.35	3.68	1.54
	5.05	5.76	5.02	6.03	.83	2.37	2.52	.56	1.88	.74	3.49	1.55
	3.37	4.33	5.08	6.28	.84	1.97	1.64	.60	1.51	.88	1.88	3.08
Mar.	3.79	4.58	5.87	8.41	.69	1.61	1.31	.69	1.69	1.28	1.88	3.92
	3.01	4.91	6.55	6.68	.71	1.54	.95	.63	1.43	1.32	2.38	3.46
	3.50	4.06	6.22	6.33	.80	1.50	.86	1.11	1.27	1.47	2.04	3.41
	3.50	3.59	5.07	6.06	.66	1.25	.50	1.75	1.40	1.14	2.28	3.32

* United States data are unofficial figures compiled from *Price Current-Grain Reporter;* Fort William and Port Arthur data are official figures for net receipts furnished by Canadian Board of Grain Commissioners; Vancouver data are official figures compiled from *Canadian Grain Statistics.* United States and Fort William and Port Arthur figures begin with weeks ending Dec. 5, 1925, Dec. 4, 1926, Dec. 3, 1927, Dec. 1, 1928; Vancouver figures are for weeks ending one day earlier.

[a] Receipts at Prince Rupert included.

TABLE IV.—INTERNATIONAL TRADE IN WHEAT AND FLOUR, MONTHLY, JULY–MARCH, 1928–29*

(*Million bushels*)

A.—NET EXPORTS

Month	United States	Canada	India	Australia	Argentina	Roumania	Hungary	Jugo-Slavia	Poland	Algeria	Tunis	Egypt
July	5.13	35.92	1.19[a]	5.02	9.56	.04	.62	.17	(1.41)[b]	.58	.96	(.44)[b]
Aug.	13.94	29.18	.51[a]	4.43	6.51	.36	2.46	2.96	(.53)[b]	.70	1.05	(.74)[b]
Sept.	21.25	30.89	.25[a]	2.79	8.29	.29	2.38	2.03	(.53)[b]	.74	.78	(.73)[b]
Oct.	26.65	48.89	.05	4.55	12.00	.47	2.32	.58	(.20)[b]	.42	.56	(.75)[b]
Nov.	13.62	80.56	(1.36)[b]	5.93	12.73	.18	2.14	.22	(.13)[b]	.47	.41	(1.10)[b]
Dec.	10.97	53.22	(1.29)[b]	8.39	.....	.09	2.44	.06	(.20)[b]	.45	...	(1.37)[b]
Jan.	6.70	24.93	(6.50)[b]	18.66	.....	...	1.58	....	(.18)[b]	...	...	(1.60)[b]
Feb.	7.18	19.19	(4.82)[b]	16.67	27.25	...	1.55	....	(.18)[b]	...	...	(1.50)[b]
Mar.	7.90	27.37	....	.....	.....	...	....	....	.....	...	...	.....

B.—NET IMPORTS

Month	Irish Free St.	United Kingdom	France	Germany	Belgium	Italy	Nether-lands	Scandi-navia	Switzer-land	Czecho-Slovakia	Baltic States[c]	Japan
July	1.37	19.36	3.26	6.96	3.68	8.57	1.71	1.78	1.41	1.33	.64	.63[a]
Aug.	1.42	16.44	4.41	6.67	3.73	5.33	2.25	2.67	1.12	1.57	.88	.45[a]
Sept.	1.77	14.17	5.13	7.71	3.95	5.56	3.52	2.87	1.24	1.88	.90	.43[a]
Oct.	2.09	13.44	4.31	7.15	3.39	7.44	2.52	2.55	1.50	2.52	1.31	.85
Nov.	.73	15.92	3.83	4.99	3.79	7.21	2.55	2.85	1.14	1.73	1.17	.64
Dec.	1.57	20.54	3.47	4.54	3.65	7.09	2.54	3.16	1.69	1.36	.81	1.40
Jan.	1.44	18.13	....	4.43	2.89	6.96	2.80	2.78	1.30	1.25	.61[d]	1.96
Feb.	1.59	14.14	....	2.18	2.90	5.94	1.69	1.70	.46	.94	.54[d]	2.56
Mar.	....	18.14	....	....	....	....	....	....	....	....	....	....

* Data from official sources and International Institute of Agriculture.

[a] Gross, not net. [b] Net import. [c] Finland, Esthonia, Latvia. [d] Excluding Latvia.

TABLE V.—WEEKLY WHEAT AND FLOUR SHIPMENTS BY AREAS OF ORIGIN AND DESTINATION, DECEMBER–MARCH 1928–29*

(*Million bushels*)

Week ending	North America	Argentina, Uruguay	Australia	Russia	Danube	India	Other countries	Total	To Europe	To ex-Europe
Dec. 1	15.42	3.96	1.17	.....	...	.....	2.18	22.73	18.15	4.58
8	9.90	3.27	1.48	.....	.10	.....	1.91	16.66	12.44	4.22
15	10.91	3.46	1.54	.....	.06	.....	1.51	17.48	13.14	4.34
22	8.43	3.42	2.86	.....	...	.....	.86	15.57	10.03	5.54
29	13.57	3.62	1.92	.....	...	.....	1.18	20.29	15.40	4.89
Jan. 5	11.17	3.46	4.42	.....	.06	.....	1.06	20.17	12.78	7.39
12	11.11	4.98	4.96	.....	...	.....	.92	21.97	15.64	6.33
19	12.83	4.21	3.93	.....	.11	.....	.78	21.86	14.09	7.77
26	10.38	5.62	4.75	.....	...	.....	.62	21.37	14.83	6.54
Feb. 2	11.33	6.17	4.54	.....	...	.....	.94	22.98	15.57	7.41
9	11.26	7.01	4.40	.....	...	.....	.66	23.33	15.12	8.21
16	8.11	6.24	3.79	.....	...	.....	.90	19.04	14.28	4.76
23	9.39	6.76	3.78	.....	...	.....	.58	20.51	14.69	5.82
Mar. 2	9.69	7.26	4.12	.....	...	.....	.57	21.64	14.66	6.98
9	7.10	10.30	3.98	.....	...	.....	.46	21.84	16.37	5.47
16	7.07	5.64	4.76	.....	.10	.....	.62	18.19	12.42	5.77
23	8.14	8.15	3.63	.....	...	.....	.50	20.42	15.63	4.79
30	8.69	5.45	3.46	.....	.05	.....	.41	18.06	12.15	5.91

* Here converted from data in Broomhall's *Corn Trade News*. Broomhall's weekly figures do not always check with his cumulative totals, which presumably include later revisions. Shipments from "other countries" apparently include a part of the shipments from the Danube and Russia in most weeks.

TABLE VI.—WEEKLY VISIBLE SUPPLIES OF WHEAT IN NORTH AMERICA, UNITED KINGDOM PORTS, AND AFLOAT TO EUROPE, DECEMBER–MARCH 1928–29*

(*Million bushels*)

Date	United States	Canada	U.K. ports	Afloat to Europe	Total	Date	United States	Canada	U.K. ports	Afloat to Europe	Total
Dec. 1	145.2	184.3	5.7	63.5	398.7	Feb. 2	133.8	212.9	6.6	64.8	418.1
8	143.8	201.9	6.0	59.0	410.7	9	130.9	210.0	5.6	71.4	417.9
15	144.9	213.0	6.8	55.0	419.7	16	130.0	204.9	6.4	70.1	411.4
22	145.9	224.5	6.9	49.2	426.5	23	129.0	210.0	5.8	69.9	414.7
29	146.8	227.3	6.2	54.4	434.7	Mar. 2	130.0	201.6	6.0	70.0	407.6
Jan. 5	146.0	230.8	6.1	53.2	436.1	9	130.9	197.5	6.0	73.6	408.0
12	142.3	228.3	6.6	57.6	434.8	16	130.0	195.2	6.4	71.3	402.9
19	138.1	221.5	6.2	60.4	426.2	23	129.3	192.5	7.1	68.9	397.8
26	136.2	215.7	5.8	63.0	420.7	30	128.3	187.9	7.4	70.9	394.5

* United States data are *Bradstreet's;* Canadian data from *Canadian Grain Statistics;* United Kingdom and Afloat data from Broomhall's *Corn Trade News.* Canadian figures are for the days preceding the dates indicated in the above table, and include stocks in some elevators for the preceding week, but are adjusted to bring stocks in western country elevators to the correct week.

TABLE VII.—WORLD VISIBLE WHEAT SUPPLIES, APRIL 1, 1920–29, AND MONTHLY, 1928–29*

(*Million bushels*)

Date	United States	Canada	Argentina	Australia	United Kingdom	Afloat to Europe	North America	Argentina, Australia	U.K. and afloat	Grand total	Total ex-Australia
1920 Apr. 1	94.9	28.2	6.6	60.0	10.9	59.7	123.1	66.6	70.6	260.3	200.3
1921 Apr. 1	51.7	40.6	3.7	73.0	18.4	58.2	92.3	76.7	76.6	245.6	172.6
1922 Apr. 1	69.4	63.3	4.8	50.0	6.5	65.9	132.7	54.8	72.4	259.9	209.9
1923 Apr. 1	102.1	81.8	9.2	56.5	7.8	52.8	183.9	65.7	60.6	310.2	253.7
1924 Apr. 1	111.3	123.3	10.6	40.0	8.5	65.8	234.6	50.6	74.3	359.5	319.5
1925 Apr. 1	108.8	80.0	11.4	63.0	11.7	84.1	188.8	74.4	95.8	359.0	296.0
1926 Apr. 1	82.0	99.0	6.6	30.5	7.7	46.0	181.0	37.1	53.7	271.8	241.3
1927 Apr. 1	88.7	107.3	14.7	53.0	5.0	75.7	196.0	67.7	80.6	344.3	291.3
1928 Apr. 1	110.1	146.6	12.8	36.0	7.7	68.4	256.7	48.8	76.1	381.6	345.6
1928 Aug. 1	88.1	69.2	5.9	9.5	10.1	44.7	157.3	15.4	54.8	227.5	218.0
Sept. 1	135.9	30.5	8.5	5.2	9.5	43.7	166.4	13.7	53.2	233.3	228.1
Oct. 1	181.8	76.5	7.3	3.4	7.8	41.1	258.3	10.7	48.9	317.9	314.5
Nov. 1	204.4	155.1	7.3	1.3	5.9	50.3	359.5	8.6	56.2	424.3	423.0
Dec. 1	208.0	169.5	4.4	8.0	5.7	63.5	377.5	12.4	69.2	459.1	451.1
1929 Jan. 1	204.7	218.6	5.9	75.0	6.2	54.4	423.3	80.9	60.6	564.8	489.8
Feb. 1	186.7	208.2	10.3	76.5	6.5	64.8	394.9	86.8	71.3	553.0	476.5
Mar. 1	179.8	195.2	12.8	63.0	5.8	70.1	375.0	75.8	75.9	526.7	463.7
Apr. 1	173.1	177.1	14.7	53.0	8.0	71.0	350.2	67.7	79.0	496.9	443.9
Average, Apr. 1											
1910–14	84.0	37.6	4.3	14.8	12.4	53.2	121.6	19.1	65.6	206.3	191.5
1924–28	100.1	111.3	11.3	44.5	8.1	68.0	211.4	55.8	76.1	343.3	298.8

* A joint compilation by Broomhall, the *Daily Market Record,* Minneapolis, and the *Daily Trade Bulletin,* Chicago; here summarized from Broomhall's *Corn Trade News* and the *Daily Trade Bulletin.* Includes some flour stocks.

TABLE VIII.—WEEKLY CASH PRICES OF REPRESENTATIVE WHEATS IN LEADING EXPORTING AND IMPORTING MARKETS, DECEMBER–MARCH 1928–29*

(*U.S. dollars per bushel*)

Month	United States				Canada		Argentina	Liverpool				
	No. 2 Red Winter (St. Louis)	No. 2 Hard Winter (Kansas City)	No. 1 Northern Spring (Minneapolis)	No. 2 Amber Durum (Minneapolis)	No. 1 Manitoba (Winnipeg)	No. 3 Manitoba (Winnipeg)	Barletta (Buenos Aires)	No. 1 Manitoba	No. 3 Manitoba	Pacific White	Argentine Rosafe	Australian
Dec.	1.43	1.13	1.17	1.17	1.17	1.09	1.13	1.48	1.37	1.43	1.28	1.44
	1.41	1.11	1.15	1.07	1.17	1.09	1.12	1.47	1.37	1.42	1.28	1.31
	1.37	1.11	1.15	1.10	1.17	1.09	1.12	1.47	1.37	1.41	1.27	1.41
	1.35	1.10	1.14	1.09	1.17	1.09	1.11	1.47	1.37	1.41	1.27	1.40
Jan.	1.35	1.08	1.15	1.11	1.16	1.07	1.10	1.48	1.36	1.39	1.27	1.38
	1.41	1.08	1.18	....	1.18	1.10	1.12	1.46	1.36	1.40	1.25	1.40
	1.41	1.14	1.22	1.22	1.21	1.13	1.14	1.49	1.41	1.42	1.30	1.42
	1.42	1.19	1.24	1.38	1.25	1.16	1.15	1.52	1.43	1.43	1.31	1.43
Feb.	1.44	1.17	1.25	1.32	1.25	1.16	1.14	1.53	1.44	1.44	1.31	1.42
	1.39	1.17	1.26	1.32	1.25	1.17	1.14	1.55	1.45	1.43	1.33	1.43
	1.41	1.18	1.28	1.29	1.28	1.20	1.16	1.54	1.46	1.46	1.31	1.46
	1.45	1.20	1.30	1.30	1.31	1.23	1.16	1.55	1.49	1.45	1.34	1.46
Mar.	1.38	1.18	1.28	1.26	1.28	1.20	1.15	1.54	1.46	1.42	1.32	1.44
	1.35	1.17	1.25	1.29	1.27	1.19	1.15	1.53	1.45	1.40	1.32	1.43
	1.39	1.19	1.26	1.23	1.29	1.21	1.15	1.52	1.44	1.40	1.30	1.41
	1.39	1.17	1.26	1.23	1.26	1.19	1.12	1.52	1.43	1.41[a]	1.29	1.41[a]
	1.30	1.12	1.21	1.17	1.24	1.16	1.12	1.49	1.40	1.38[a]	1.30	1.38[a]

* United States prices are weekly averages of daily weighted prices for weeks ending Friday, compiled from *Crops and Markets*. Canadian prices are averages for weeks ending Saturday, compiled from *Canadian Grain Statistics*. Liverpool prices are for Tuesday of the same week, parcels to Liverpool or London, and are from Broomhall's *Corn Trade News*, except Pacific White and Australian, which are Friday prices furnished by the International Institute of Agriculture. Argentine prices are averages for weeks ending Saturday, from *Revista Semanal*.

[a] Tuesday prices from Broomhall's *Corn Trade News*.

TABLE IX.—MONTHLY PRICES OF DOMESTIC WHEAT IN EUROPE, FROM AUGUST 1926*

(*U.S. dollars per bushel*)

Month	Great Britain			France (Charters)			Italy (Milan)			Germany (Berlin)		
	1926–27	1927–28	1928–29	1926–27	1927–28	1928–29	1926–27	1927–28	1928–29	1926–27	1927–28	1928–29
Aug.	1.76	1.63	1.33	1.61	1.75	1.60	1.85	1.75[a]	1.72	1.75	1.78[b]	1.49
Sept.	1.46	1.43	1.19	1.77	1.57	1.58	2.03	1.73	1.81	1.71	1.68	1.36
Oct.	1.48	1.37	1.24	1.88	1.54	1.61	2.21	1.77	1.88	1.72	1.62	1.38
Nov.	1.62	1.32	1.28	1.96	1.48	1.60	2.20	1.90	1.87	1.78	1.57	1.37
Dec.	1.55	1.29	1.25	1.78	1.58	1.56	2.31	1.88	1.87	1.74	1.53	1.33
Jan.	1.55	1.29	1.25	1.88	1.58	1.59	2.13	1.93	1.92	1.72	1.52	1.35
Feb.	1.54	1.26	1.27	1.81	1.56	1.64	2.11	1.94	1.96	1.72	1.49	1.40
Mar.	1.52	1.27	1.27	1.70	1.65	1.69	2.11	2.00	1.96[a]	1.73	1.59	....
Apr.	1.50	1.34	....	1.82	1.74	....	2.02	2.09	....	1.76	1.72	....
May	1.58	1.43	....	1.91	1.87	....	2.16	2.14	....	1.92	1.73	....
June	1.65	1.43	....	1.88	1.85	....	1.99	2.10	....	1.96[c]	1.66	....
July	1.64	1.41	....	1.81	1.76	....	1.80	1.77	....	n.q.	1.60	....

* Data for Great Britain are averages of weekly average *Gazette* prices as given in the *Economist;* for France, averages of Saturday prices furnished directly by Federal Reserve Board; for Italy, averages of Friday prices of soft wheat as given in *International Crop Report and Agricultural Statistics;* for Germany, monthly average prices as given in *Wirtschaft und Statistik*. All data are converted, for convenience, from the domestic currency in which they are quoted in the above sources into U.S. money by monthly average exchange rates. No quotation is signified by "n.q."

[a] Three-week average. [b] Second half of August. [c] First half of June.

TABLE X.—WHEAT STOCKS IN THE UNITED STATES AND CANADA, MARCH 1919–29*

(*Thousand bushels*)

Year	United States (March 1)				Canada (March 31)				
	Total	On farms	In country mills and elevators	Commercial visible (Bradstreet's)	Total	On farms	In elevators	In transit	In flour mills
1919	362,947	128,703	107,037	127,207	118,543	32,315	69,983	10,855	5,390
1920	351,769	169,904	123,233	58,632	77,306	34,837	30,622	6,272	5,575
1921	336,057	217,037	87,075	31,945	95,477	48,919	35,802	7,120	3,636
1922	256,038	134,253	75,071	46,714	114,986	41,649	58,338	10,999	4,000
1923	313,557	156,087	102,908	54,562	139,788	54,771	69,620	8,397	7,000
1924	308,919	137,721	98,284	72,914	202,493	70,755	111,589	14,149	6,000
1925	256,205	112,095	67,673	76,437	121,084	39,225	68,555	8,304	5,000
1926	224,575	100,137	76,333	48,105	161,376	50,878	95,691	8,307	6,500
1927	277,473	130,274	85,928	61,271	175,978	51,366	103,372	14,740	6,500
1928	286,559	130,944	75,428	80,187	224,699	69,807	130,055	19,037	5,800
1929	357,258	148,813	78,411	130,034	244,423	60,517	164,291	12,615	7,000

* *Bradstreet's* visible, and official data of U.S. Department of Agriculture and Dominion Bureau of Statistics. See especially *Agriculture Yearbooks, Canada Year Books, Northwestern Miller,* and press releases.

TABLE XI.—APPROXIMATE DISPOSITION OF WHEAT SUPPLIES IN FOUR LEADING EXPORTING COUNTRIES, 1924–25 TO 1928–29*

(*Million bushels*)

Item	United States (July–June)					Canada (August–July)				
	1924–25	1925–26	1926–27	1927–28	1928–29	1924–25	1925–26	1926–27	1927–28	1928–29
Initial stocks	165	135	111	138	142	41	26	35	48	75
New crop	864	676	831	878	903	262	395	407	480	534
Total supplies	1,029	811	942	1,016	1,045	303	421	442	528	609
Net exports	258	95	209	194	140	192	324	292	332	430
Seed requirements	84	82	88	94	90	38	40	39	41	42
Consumed for food	479	492	492	505	507	42	42	43	44	45
Unmerchantable, lost in cleaning, fed on farms	73	31	15	81	88	22	18	31	43	43
Apparent error in crop estimate						—17	—38	—11	—7	—16
Stocks at end	135	111	138	142	220	26	35	48	75	65
Total disappearance	1,029	811	942	1,016	1,045	303	421	442	528	609

Item	Argentina (August–July)					Australia (August–July)				
	1924–25	1925–26	1926–27	1927–28	1928–29	1924–25	1925–26	1926–27	1927–28	1928–29
Initial stocks	66	56	61	65	70	38	36	30	41	40
New crop	191	191	221	239	300	165	115	161	117	159
Total supplies	257	247	282	304	370	203	151	191	158	199
Net exports	123	94	143	178	215	124	77	103	70	115
Seed requirements	23	25	24	25	26	11	11	12	14	14
Consumed for food	53	54	57	59	61	29	29	30	30	31
Feed and waste	2	10	3	3	4	3	4	5	4	5
Apparent error in crop estimate	...	+3	—10	—31	64	...	...	...	...	34
Stocks at end	56	61	65	70		36	30	41	40	
Total disappearance	257	247	282	304	370	203	151	191	158	199

* Based so far as possible upon official estimates for the various items of supply and disposition. Estimates for 1928–29 are preliminary. For detailed explanation of our method of estimation and adjustment of items in the disposition table, see notes in WHEAT STUDIES, V, 111 f. The Argentine crop figure for 1928 is our own approximation.

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 7 JUNE 1929

VARIATIONS IN WHEAT PRICES

THE effort for stabilization of the general price level implies the occurrence of significant degrees of variation in the general price level. Agitation for stabilization of the price of a particular commodity, like wheat, similarly implies significant variations in price. The meaning and causes of wheat price variations have long been entangled in controversies over the prevailing system of marketing wheat. But to a surprising extent the variations themselves have not been classified, described, and explained. Analysis of wheat price variations is essential as a background to the consideration of stabilization of the price of wheat. The purpose of this study, a tentative incursion into the subject, is to offer a non-technical picture of wheat price variations, principally in the United States, during the past three decades.

We have first attempted to define the various significant types of variation. Thereafter, using several series of cash wheat prices, we have sought to illustrate the amplitude of movement in each type of variation; to indicate the immediate and distant influences to which variations may principally be traced; and to contrast variations occurring in pre-war years with those occurring in post-war years. Short-time fluctuations, month-to-month changes, recurrent seasonal movements, and shifts in wheat price level from crop year to crop year are interrelated, and difficult to separate one from the other. The price of wheat at any time is not a point, but a wide range. Consequently, on the basis of available price series, a good deal of uncertainty necessarily surrounds any attempt to describe and measure wheat price fluctuations, and to point out the principal causes of variation. The present study is not offered as conclusive; but it serves to throw into relief certain characteristics of wheat price movements which seem to require attention whenever wheat price stabilization is discussed.

STANFORD UNIVERSITY, CALIFORNIA

June 1929

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

The central feature of the series is a periodic analysis of the world wheat situation, with special reference to the outlook for supplies, requirements, trade, and prices. Each volume includes a comprehensive review of the preceding crop year, and three surveys of current developments at intervals of about four months. These issues contain a careful selection of relevant statistical material, presented in detail in appendix tables for reference purposes, and in summary form in text tables and charts.

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Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.
Published by Stanford University for the Food Research Institute.

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FOOD RESEARCH INSTITUTE

STANFORD UNIVERSITY, CALIFORNIA

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The Food Research Institute was established at Stanford University in 1921 jointly by the Carnegie Corporation of New York and the Trustees of Leland Stanford Junior University, for research in the production, distribution, and consumption of food.

VARIATIONS IN WHEAT PRICES

I. INTRODUCTION

Price stabilization is a promulgation of increasing vogue, whether in the realm of the price level of commodities as a whole or in the case of individual commodities. There is no question that prices of most agricultural and industrial products have been and are quite variable; also, that the variations, however occasioned, create indeterminate business problems. To a lesser but still important degree, the complex of prices that make up the general level of prices is variable or unstable, giving rise to major economic problems. Both sorts of instability have received considerable attention in connection with the post-war agricultural depression, and by many price stabilization is regarded as an important element in a progressive national policy for agriculture. Effective discussion of stabilization measures must rest upon a clear understanding of the character and extent of price instability or variation, and of the forces which cause and limit these variations.

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Wheat, in common with many other commodities, displays differences and variations in price. These differences and variations are of three major classes: of region, of time, and of composition. At any one time and at any point, wheats differ in type, grade, quality, and accordingly in price. In different regions or locations within a region, at a given time, wheats of the same type, grade, or quality will differ in price, largely because of the different costs involved in getting them to the most appropriate market. At different times, in a single market, even the same type, grade, or quality of wheat will command different prices. In the present discussion we are concerned primarily with the fluctuations, movements, or variations in wheat prices over periods of time; but some consideration of qualitative and geographic differences is necessary if one is to deal intelligently with the complex data of actual wheat prices.

The price of any commodity, over periods of time, is subject to general and special influences. The general influences are related to monetary conditions and the price level of the various goods and services included in the economic and social life of the people. The special influences are related to the supply of and demand for the commodity, its substitutes, and those for which it may be substituted. In every analysis of behavior of prices, the segregation of the two sets of influences should be sought, however difficult of accomplishment.

In the case of wheat prices, the effects of major influences operating upon prices in general are readily discernible over periods of considerable length. The relation between business conditions in general and wheat prices in particular has not been intensively studied, but Engberg[1] is probably right in finding "very little effect of business cycles in the United States on the price of wheat." It is different with long-term trends of prices. In the two or three decades prior to 1895, wheat prices, like the general price level, showed a downward trend, while in the two decades prior to the war, both showed an upward trend; both tended sharply upward during the war; and both suffered a readjustment to a lower level in 1920–21. The trends of wheat prices have not been identical with the trends of prices in general, but both show the effects of powerful underlying causes; and one cannot interpret the trends of wheat prices without first dividing them

[1] *Industrial Prosperity and the Farmer* (New York, Macmillan, 1927), p. 258.

into two components, one of which represents approximately the trend resulting from general causes rather than from causes more or less peculiar to wheat. In this study, however, we are not dealing with long-time movements of wheat prices; hence we need take this matter into account only in making certain comparisons between pre-war and post-war years. The period since 1921 is too short to permit one to make a satisfactory determination of the trend in either wheat prices or in the general price level; but there has been no pronounced trend in the general price level and it is probably safe to say that the trend element in wheat prices has been relatively small.

Producers and consumers of a particular commodity are concerned both with its price level and with the variability of its prices. A durable agricultural product, like wheat, has in each crop year a mean price level more or less peculiar to, or characteristic of, the crop year. In each crop year, also, one observes fluctuations around this price level. Such fluctuations may conceivably be related either to change of the wheat price level or to developments within that price level. Both producers and consumers are interested in determining whether changes in the wheat price level, or the price fluctuations around this level, are based strictly upon proved facts of supply and demand, as contrasted with fallacious news, propaganda, misinterpretation, or manipulation.

Wheat growers in all countries seem to have arrived at the inference that the shifts in wheat price level from one crop year to another are frequently excessive, in view of underlying facts. Also, price fluctuations within the crop year have come to be regarded by growers as excessive, and in part artificial, in the sense of not being founded solely on considerations of supply and demand. These inferences have found reflection in the legislative halls of the countries most deeply concerned. Among the numerous elements in the business and political problem of wheat growing, the price level of wheat, and variations in wheat prices, have been of outstanding prominence.

The Federal Trade Commission, in the course of its extensive investigations of the grain trade, gave attention to the variability of wheat prices before our entrance into the war. Latterly, the Grain Futures Administration has given attention to fluctuations in wheat prices since the war, using a different method from that employed by the Federal Trade Commission. Comprehensive, long-term statistical studies are lacking—a rather curious situation in view of the importance of the commodity, but largely explained by the extraordinary complexity of the questions involved.

The following pages present an analysis and appraisal of variations in wheat prices, without pretension to exhaustive treatment in compilation or mathematical interpretation of data. What is sought instead is to present definitions of the variabilities involved, to indicate in a general way their occurrence and extent, and to arrive at such broad inferences as may be secured by an inductive method. The subject is in need of a thoroughgoing overhauling, but this can be undertaken only on the basis of source material collected with special reference to particular phases of the problem.[1]

A comparison of the variability of wheat prices, contrasted with that of other commodities, will serve as a preliminary orientation. Following this, it will be necessary to consider the nature of the price quotations to be employed. We shall then distinguish the several kinds of fluctuations, or variations, in the price of wheat. We next consider the extent and amplitude of the variations of the three principal types, and the causal influences to which each may be attributed. Finally brief consideration is given to the variability of the farm price of wheat and to a comparison of pre-war with post-war variability. Since what we have to say on the comparative variability of wheat prices is designed merely to serve as a background, it may appropriately be included in the introduction.

The Comparative Variability of Wheat Prices

How variable is the price of wheat? It seems to be widely believed that the price of wheat is highly variable—not only highly

[1] For an interesting incursion into the subject, see V. P. Timoshenko, *Wheat Prices and the World Wheat Market* (Cornell University Agricultural Experiment Station Memoir 118), December 1928.

variable when considered by itself, but also highly variable when compared with the prices of other staple commodities. It is not difficult to show that this view borders on misapprehension.

Unless subject to regulation, the prices of all commodities display fluctuations—day-to-day, week-to-week, month-to-month, and year-to-year variations. The various commodities, however, display wide differences in the amplitudes and frequencies of their price variations. Some of the differences in variability are related to the physical and chemical constitution of the commodity; other variabilities of price are related to circumstances in primary production or ultimate consumption; still other variabilities of price originate in conditions in the channels of distribution. In the course of time, other things equal, the variations in the price of each commodity tend to evolve a type of price variation more or less characteristic of that commodity.

F. C. Mills' recent volume on *The Behavior of Prices* contains an extensive series of computations of price variabilities of many commodities over the period from 1890 to 1925. Table 1, prepared from these data, shows the measures of price variability, at wholesale, of twenty-four agricultural products, with corresponding measures for fourteen basic industrial materials to serve as contrast. Measures are given both for month-to-month and for year-to-year variability.

For wheat, the wholesale price of No. 1 Northern Spring wheat at Minneapolis was used. It is informative to observe that the month-to-month variability of the spring-wheat price was less than that observed with a considerable number of basic materials, including pig iron, steel billets, jute, brick, tar, and turpentine. Among the cereals, rice stood lowest in monthly price variability, with wheat next, followed by rye, barley, corn, and oats in the order named.[1] In respect to year-to-year variability of price, it is instructive to observe that several metals quite generally have displayed more year-to-year variability of

[1] Cf. also Federal Trade Commission, *Prices of Grain and Grain Futures* (Report . . . . on the Grain Trade, Vol. 6), 1924, pp. 27–28.

TABLE 1.—MEASURES OF PRICE VARIABILITY OF LEADING AGRICULTURAL AND INDUSTRIAL COMMODITIES, AT WHOLESALE*

(Per cent)

Commodity	Monthly variability 1890–1925 excluding 1914–21	Year-to-year variability 1890–1924
Rice	3.7	11.9
Wool: fine clothing	4.5	14.3
Wool: medium	4.9	15.3
Cattle: good to choice	5.0	9.8
Cattle: choice to prime	5.6	10.5
Wheat: spring	*6.8*	*13.9*
Hay	7.0	12.3
Beans	7.2	18.9
Flaxseed	7.7	17.9
Hogs: heavy	7.8	16.1
Hogs: light	7.8	16.0
Cotton	8.1	18.2
Hides	8.7	15.2
Rye	8.7	18.1
Barley	9.0	16.3
Corn	10.3	17.6
Oats	10.9	16.6
Sheep: wethers	11.5	12.9
Sheep: ewes	12.5	14.6
Milk	12.6	3.0
Hops	19.8	31.2
Eggs	23.1	8.3
Potatoes	26.4	39.4
Onions	28.4	32.3
Acid: sulphuric	2.9	10.8
Acid: muriatic	3.0	14.0
Copper: ingot	4.9	15.2
Silk: raw, Japanese	5.2	13.3
Zinc: slab	6.0	17.8
Glass: window	6.2	14.8
Rope	6.3	16.4
Steel billets	7.2	21.3
Brick	7.5	13.9
Pig iron: Bessemer	7.8	19.8
Tar	8.2	13.6
Jute	8.2	17.5
Turpentine: spirits of	8.9	19.6
Coke	13.9	36.3

* Data from F. C. Mills, *The Behavior of Prices* (New York, 1927), pp. 489, 491, 492, 493, 497, 499, 500, 501. Based on wholesale prices compiled by the Bureau of Labor Statistics and used in its index numbers. The figures for month-to-month variability are obtained, according to Mills, by calculating for each year the mean deviation of the monthly prices from the average price of the year, expressing this mean as a percentage of the average price for the year and then averaging the resulting percentages for the several years. The figures for year-to-year variability are obtained by computing the percentage changes of average annual prices from year to year and then calculating the average deviation of these percentages from their mean. The series of month-to-month and year-to-year variability are not comparable; one compares the articles with each other in each series.

price than wheat. Among the cereals, rice again stands lowest, with wheat next, followed by barley, oats, corn, and rye in the order named.[1] From these computations we learn that wheat is not characterized by a relatively high degree of price variability: it is, after rice, the least variable of the cereals, and exhibits less variability, both month-to-month and year-to-year, than the prices of important basic materials whose outturn is more or less controllable by management as well as independent of climatic influences.

In short, whatever the nature, frequency, and extent of variation of wheat prices, wheat is not a commodity that stands out on the basis of price variability. From this it does not follow, however, that such variability of price as does occur is therefore of secondary importance.

II. TYPES OF WHEAT PRICE VARIATIONS

The variations in wheat prices in terminal markets may be segregated, at least theoretically, into four principal types. One of these may be termed *inter-seasonal,* representing shifts in the wheat price level from one crop year to another. The others are *intra-seasonal,* representing (1) a recurring seasonal movement, (2) irregular variations extending over periods of weeks or months, and finally (3) short-term fluctuations from day to day and from week to week. These several variations are commonly construed as being of one order and are thus frequently criticized as alike adversely affecting the wheat grower's return. But they differ in the nature of the statistical data on which they are based, and in the implications contained. For the moment it will suffice to explain each type.

There are usually changes in the level of wheat prices from one crop year to another. If wheat were harvested, all over the world, in a single brief period, these shifts in level would be distinguishable far more easily than they now are. As it is, the great bulk of the world's wheat is harvested during June–September, a period of four months. Of the wheat harvested at other periods, only the harvests of Argentina and Australia are of outstanding significance, though sometimes India's harvest is an influential factor. Partly because of the length of this four months' period of harvest, partly because the prospects for harvests exert influences for weeks or months before harvest, partly because the final reckoning of the harvest cannot be made for several weeks, or even months, after the wheat is cut, the *inter-seasonal* price shifts, the changes in wheat price level from one crop year to the next, are not easily defined. One may make an average of prices in a given crop year, but different observers will seldom agree in defining what might be termed the price level characteristic of that crop year. Nevertheless, the nature and the trend of the price difference between one crop year and another can usually be ascertained for each major class, even if its precise degree cannot, provided the study includes the movements in international markets. Not infrequently these inter-seasonal shifts are quite substantial. It is to these, in discussions of the depressing effects of "climatic" surpluses on prices, that attention ought to be particularly directed.

There are variations having a seasonal behavior. In each wheat-producing country, whatever its harvest period, prices tend to decline as new wheat moves to market, to reach a minimum some weeks later when the end-season shortage is entirely relieved and stocks begin to press upon storage or transportation facilities, then to rise during the rest of the season because of (but not in exact correspondence with) the cumulative cost of carrying charges—storage, interest, insurance, etc. Satisfactory statistical expression of this recurring seasonal movement of prices, in itself quite characteristic, is difficult to obtain. There are variations in the dates of harvest, the length of the harvest period, and the pressure upon farmers to sell their grain promptly. The recurring seasonal movement may be obscured by short-term and month-to-month fluctuations, next to be mentioned, which are difficult to separate from the seasonal variation proper. Also, an inter-seasonal wheat price change may exagger-

ate or minimize the seasonal wheat price movement. There is no doubt that such a recurring seasonal influence exists; but it is difficult to approximate it, for a single crop year, within reasonable limits of error, and averages are likely to yield unreliable results.

There are fluctuations arising from other than recurring seasonal influences which affect prices over periods longer than a week or two, and frequently cause movements of substantial proportions. These may be conveniently studied in month-to-month variations, although for certain purposes more refined data are necessary. These fluctuations, unlike the true seasonal movement, are likely to be irregular in occurrence, unequal in degree, and unlike in form. The causes, which are quite different from those which are responsible for recurring seasonal movements, are for the most part irregular changes in the actual and prospective market supply or demand, not only in the United States but on the world market. It is always more or less difficult to separate the month-to-month variations that are regional and temporary from those associated with the recurring seasonal price movement, a shift in wheat price level from one crop year to another, or changes due to the influence of a transient but extraordinary domestic or international circumstance. Looking back over a protracted period, one comes to the realization that pronounced month-to-month variations have usually arisen from exceptional causes.

Lastly, there are price fluctuations occurring within the trading day, from day to day, and over such brief periods as a week or two. These short-term fluctuations occur even in periods when visible influences are not pronounced; but they tend to be exaggerated when obvious factors are disturbing the level of wheat prices. They represent largely the joint results of temporary shifts in demand and supply for actual wheat, and the speculative and hedging dealings in futures contracts. These fluctuations lie for the most part within what Taussig has termed the "penumbra" of price-determining operations.

The four types of fluctuations are distinguishable in principle, but not readily separable and measurable. The causes of the different types influence one another, and the results are so overlapping and interrelated that at times experienced persons would not agree in the differentiation of them. Wheats are so varied in quality, and the quantities of wheats of different qualities are so different from region to region, from year to year, and within a market, that the price situation is inevitably difficult of analysis.

Short-Term Variations

It is possible to dismiss the short-term fluctuations with a few words, chiefly descriptive; for these short-term movements, broadly speaking, do not lend themselves to significant economic analysis except in connection with a refined study of what is sometimes called the technical position of the market, or with exceptional month-to-month variations. The day-to-day and week-to-week fluctuations may be considerable. The price movement of a day may be within a range of a cent up to several cents a bushel. A rise or decline of 5 cents in a week occurs occasionally; indeed, week-to-week fluctuations may be substantially larger. To a considerable extent they represent what may be called accidents or incidents in the "higgling of the market"; or a sort of surge and ebb, as of a tide, that is inevitable on every large market, even in the case of non-perishable products. They may, on the other hand, represent the initial steps or the progressive developments in a significant movement of longer duration, from month to month, or in the shift in the wheat price level from one year to another.

The short-term fluctuations of the wheat price are of almost infinite variety. The opening quotation may be the highest or lowest of the day, the closing quotation may be the highest or lowest of the day, a mid-session quotation may be the highest or lowest of the day; the price may rise after the opening of the market and decline before the close, or decline after the opening and rise before the close; the trend of the day may be upward or downward, or the fluctuation may resemble an oscillation. The variations on one day may be merely the repetition of the previous day; or the price may be tending to rise or fall. Some-

times the price will rise or decline precipitously; it may remain fairly constant for a few days, and then return to the point of departure. Oscillations may occur over several days.

These short-term oscillations are sometimes more pronounced for wheats deliverable on contract than for premium wheat, more often probably the contrary. The futures market may be overbought, or oversold, on a particular day, and readjustment is promptly enforced. Each price movement upward or downward extending over several days may be the beginning of a movement that will find expression in a change of the price for the month, or it may be wiped out by a corresponding reversion. Sometimes cash prices lead futures, probably more usually futures prices lead cash prices; the subject is of little importance in the present discussion. It is to speculation that the public ascribes most of the day-to-day fluctuations; but it is quite possible that such fluctuations might be more pronounced if the speculative forces were not in operation.

The day-to-day variations may be the steps in the change from one crop year price level to another, they may bring the average of the month higher or lower than that of the previous month, or they may balance each other to produce an average unchanged from the previous month.

Data are abundantly available for detailed study of short-time fluctuations. The daily records of transactions in the central markets are nowadays exceedingly complete. For each future there is the opening and the closing price, the highest and the lowest price.[1] Based on these futures, in the cash market there is the opening and the closing price, the highest and the lowest price, sometimes an adjusted closing price, these quotations reproducing the variations in the prices of futures applied to the prices of wheat over the entire range of the several grades. The day-to-day variations in the weighted average cash prices, as computed from carload sales in each market, are usually less than the extreme variations within the grade shown in individual transactions. The variations in the prices of futures may be misleading in one way; the variations in individual cash transactions would be misleading in another way.

There are now available official computations of the daily average weighted cash price of wheat sold in several leading markets. Inasmuch as these do not represent all the transactions, and in particular do not include a large volume of purchases by mills, such computations are somewhat incomplete though probably not seriously misleading when considered regionally.

We have not, however, undertaken, nor do we for the present purpose consider it necessary, to tabulate and study the day-to-day or week-to-week variations in the prices either of cash wheat or of futures. In such variations operate so many transitory and unimportant influences that inferences drawn from them, in respect to price movements of significance, are subject to much error. The chief importance of day-to-day and week-to-week fluctuations lies in their particular value for the intensive study of exceptional month-to-month variations.

The other types of variation in wheat prices call for more extended analysis and discussion. Before this can be undertaken, however, it is essential to consider the character of the price material available and to select the data to serve as the basis.

III. THE CHARACTER OF THE WHEAT PRICE QUOTATIONS

If one were to ask what is the price of woolen cloth, the rejoinder would be—which woolen cloth? Similarly, an inquiry into the price of steel would lead to quotations for billets, plates, rails, and ingots. In any industry turning out a series of products, one of them may be arbitrarily designated as a basis for price quotations. The same situation holds naturally for a raw commodity marketed in the state in which it was produced.

We may not confine ourselves to price variations of one grade of wheat in the United States, quite as if wheat were a

[1] There are also available the continuous quotations.

unity. Wheats of many different types, grades, and qualities are marketed side by side. The proportions of these varied classes in the total marketed supply vary greatly from year to year, within a year, and even from week to week. Consequently the prices of particular types, grades, and qualities sometimes vary considerably more than do average prices of all wheat marketed. The prices of durum wheat, which is largely used for purposes quite different from those of the bread wheats, follow a course peculiar to themselves; this is also true of Pacific wheats to a lesser extent. In certain years the prices of soft red winter wheat, which is not predominatingly a bread wheat, may be far out of line with

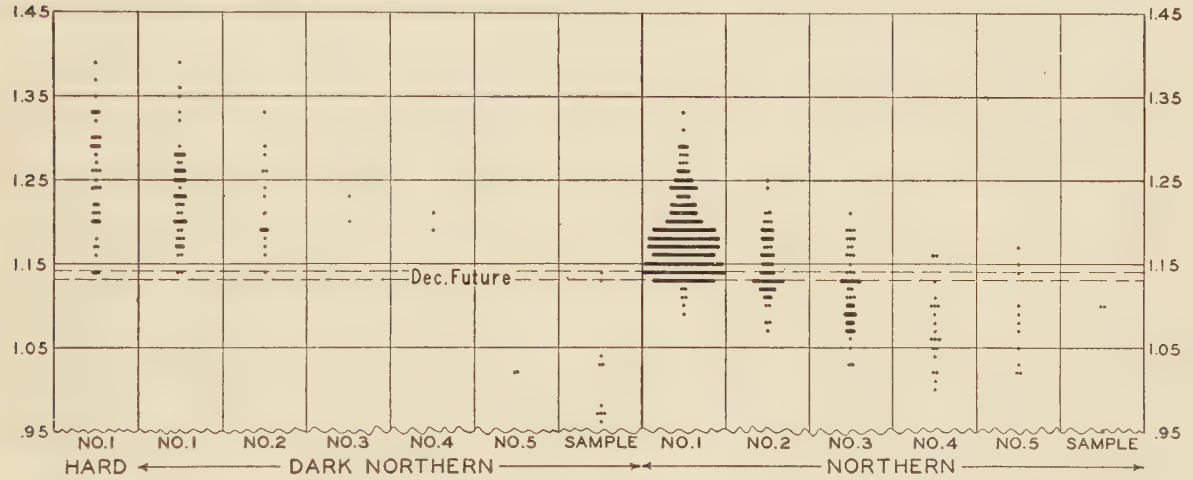
The Range of Wheat Prices

Since wheat, the commodity, is a group of entities with a range of qualities, so is the price of wheat a range. In addition to prices of cash wheat, we have quotations for futures. In a study of the variability of wheat prices, one must select such prices as are representative and comparable from year to year. Preliminary to a consideration of variations of the selected prices, it will be advantageous to secure an idea of the range of wheat prices.

As a condensed illustration of the range of prices on a single market, on a single day, within a grade and from grade to grade, Chart 1 is illuminating. It shows the

Chart 1.—Carlot Sales of Spring Wheat of Various Grades at Minneapolis, October 3, 1928*

(Dollars per bushel; one full space horizontally represents 40 cars)



* Data from *Daily Market Record*, Minneapolis, October 3, 1928.

those of other wheats. Even between hard spring and hard winter wheat, divergent price tendencies frequently appear. Moreover, the proportions of different grades and qualities of a single type of wheat differ so greatly from year to year that the course of prices of a standard grade may be quite unlike the course of average prices of all wheat of the type.[1] Premiums for wheats of high quality have a wide range, but the width of the range varies from year to year and from region to region.

[1] This is strikingly illustrated in the case of Canadian spring wheat. Cf. Wheat Studies, March 1929, V, No. 5.

prices of all carloads of Hard Spring, Dark Northern Spring, and Northern Spring wheat of various grades sold on the Minneapolis market on October 3, 1928. On that day the December future varied between 113.1 and 114.2 cents. The extreme range of carlot prices was from 95 cents a bushel for a car of Northern Spring of sample grade to 139 cents for one car of Hard Spring and one of No. 1 Dark Northern. All of the Hard Spring, all of the Dark Northern Spring except two cars of No. 5 and eight cars of sample, sold at or above the contract price, nearly all of it above. Of the commonest grade, the standard contract grade

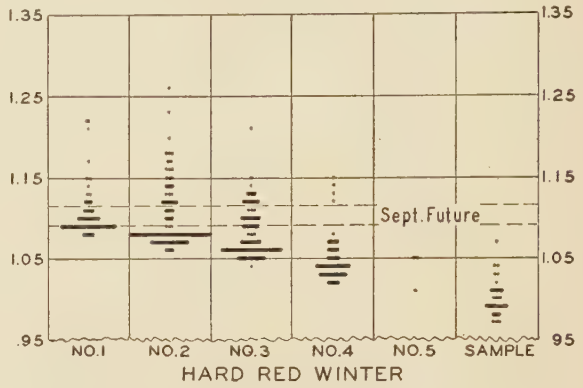
No. 1 Northern Spring, more sold at 114 cents than at any other price; and all but six carloads sold at 113 cents or more; but the range of price of carloads grading No. 1 Northern Spring was from 109 to 133 cents. Of the lower grades, each showed a fairly wide range, with median prices successively lower.

Chart 2 similarly shows the prices of carlot sales of hard winter wheat sold in Kansas City on August 3, 1928. The range was from 97 to 126 cents per bushel, with a September future varying from 109.1 to 111.5 cents. Here it is notable that a large amount of wheat sold below the low price of the September contract.

The isolated illustrations given are by no means extreme ones. For a view of the course of the range of wheat prices over a period of several years, it is convenient to resort to tabular comparisons covering only the upper grades of wheat. Table 2 gives a computation of the monthly average range of prices covering No. 1 to No. 3 spring wheat (Hard Spring, Dark Northern, and Northern) inclusive, at Minneapolis, during the crop years 1921–22 to 1927–28. Such a range is necessarily narrower than one would obtain by using all carlot sales, but it covers the grades that are of major importance and the larger part of the wheat actually sold in that market.

CHART 2.—CARLOT SALES OF HARD RED WINTER WHEAT OF VARIOUS GRADES AT KANSAS CITY, AUGUST 3, 1928*

(Dollars per bushel; one full space horizontally represents 35 cars)



* Data from *Kansas City Grain Market Review*, August 3, 1928.

TABLE 2.—RANGES BETWEEN HIGH AND LOW CASH CLOSING PRICES OF NO. 1 TO NO. 3 SPRING WHEAT AT MINNEAPOLIS, AS SHOWN BY AVERAGES OF FRIDAY PRICES*

(Cents per bushel)

Month	1921–22	1922–23	1923–24	1924–25	1925–26	1926–27	1927–28	Average	
								All years	Omitting 1924–25 and 1927–28
September	20.4	19.2	19.0	23.0	29.2	19.8	31.4	23.1	21.5
October	21.0	19.0	19.0	26.0	37.0	20.2	35.2	25.3	23.2
November	18.7	19.0	18.8	28.5	33.0	15.5	37.0	24.4	21.0
December	18.0	17.2	17.8	32.5	27.7	14.8	43.6	24.5	19.1
January	18.2	30.0	19.2	41.2	29.0	15.0	51.2	29.1	22.3
February	19.2	28.0	20.2	40.2	27.7	17.0	51.0	29.0	22.4
March	20.6	27.5	22.2	38.0	25.8	17.5	51.8	29.1	22.7
April	19.0	29.8	23.7	39.3	19.2	17.2	54.7	29.0	21.8
May	20.8	27.5	25.8	31.0	17.2	19.8	51.0	27.6	22.2
June	22.6	31.0	28.0	22.2	19.8	24.0	43.8	27.3	25.1
July	29.2	34.0	30.0	23.2	31.8	25.8	41.5	30.8	30.2
August	26.2	23.3	26.8	25.8	26.0	26.8	31.8	26.7	25.8
Average	21.2	25.5	22.5	30.9	27.0	19.4	43.7	27.2	23.1

* Data based on prices obtained from Annual Reports of the Minneapolis Chamber of Commerce and from the *Daily Market Record* (Minneapolis). During 1921–22, 1922–23, 1923–24, and 1924–25 (with a few exceptions) the highest prices were for No. 1 Dark Northern Spring wheat; beginning with 1925–26 (with some exceptions) they were for No. 1 Hard Spring wheat. The lowest prices were usually for No. 3 Northern Spring, but occasionally for No. 1 Hard Montana and No. 2 Northern wheat. Occasional high prices for fancy Montana wheats have been disregarded in selecting the high prices.

The price range changes from crop year to crop year, with variations in quantity and quality of hard spring wheat, and is influenced also by the conditions in the

winter-wheat crop. It is the expression largely of two factors: the spread from grade to grade and the extent of premium for protein. Over the past seven years this average monthly price range has varied from around 15 cents to over 50 cents per bushel. The range is most commonly narrowest in December, and widest in the spring or summer. But under exceptional circumstances, the range may be widest in the middle of the crop year, as was the case in 1924–25 and in 1927–28, or early in the crop year, as in 1925–26.

In the series are two exceptional years —namely, 1924–25 and 1927–28. These years were distinguished by extraordinary changes in the wheat price level and extreme width in the range of wheat prices. The averages of the period are thus somewhat exaggerated by including these two years. The column farthest to the right gives the averages for the period excluding these two exceptional years. This indicates a monthly average range varying from 19.1 to 23.2 cents during September–May, and rising to 25.1–30.2 cents in the three months toward the close of the spring-wheat crop year. If the exceptional month of October 1925 is eliminated, it is clear that the range is narrowest in the months of September–December, somewhat higher in January–May, and higher still in June–August.

A similar range of prices exists for hard red winter wheat and for soft red winter wheat, though each tends to be smaller than the range in spring-wheat prices. From these price ranges one gathers the important information that cash prices of different parcels of millable wheats, even within the grades deliverable on futures contracts, may vary from 15 to 50 or more cents per bushel in a single market at a given time. The point is additionally illustrated, for a different market, in a recent study presenting a weighted average of cash wheat prices at Winnipeg.[1] It may be added that the Canadian wheat pool payments for deliveries from the 1927 crop ranged from $1.42¼ for No. 1 Manitoba Northern, to $0.58¼ for a low-condition low-grade mixed wheat.[2]

The significance of this fact for a discussion of wheat price variability is twofold. It not merely reveals the difficulties that one must encounter in determining what quotations to use for a wheat price series in attempting to measure variability. It also implies that the wheat market is so highly selective, with respect to quality, that great diversity in prices of different lots of wheat occurs entirely apart from fluctuations in the general level of wheat prices. Two wheat growers selling on two successive days may get quite different prices, not so much because of price fluctuations as because their lots differ so greatly. Prices of particular qualities may easily vary more, from day to day, from month to month, and from year to year, than the level of wheat prices as a whole. Since the differentiation of wheat qualities is carried much farther today than it was before the war, the variations in price experienced by an individual grower may be much larger today than in pre-war years, even without any increase in fluctuations of the level of wheat prices.

Price Classes of Wheats

The merchandising of wheat (disregarding in this discussion Pacific wheat and durum wheat) has been restandardized since the war, partly on the basis of federal grades but predominantly on the basis of qualities not included in the specifications of the federal grades. The cash wheats may now be grouped into premium wheats, wheats deliverable on contracts, and wheats not deliverable on contracts. The three classes overlap somewhat and in each region shift from year to year. An appraisal of the effective price classes of wheats will make clear certain characteristics of the wheat market situation as related to the purchasing practices of the chief proximate consumers, the flour millers.

Premium wheats are of two groups: what may be called super-grades, and high-protein wheats. The super-grades are the federal grades above those specified as the basis of delivery on contracts. The premiums for protein (graduated according to protein content) apply to both spring and

[1] Cf. Wheat Studies, March 1929, V, No. 5, especially p. 187.

[2] J. E. Boyle, *Marketing Canada's Wheat* (published by Winnipeg Grain Exchange, 1929), p. 29.

winter wheats, within any grade, almost, but varying from year to year. The second class of wheats comprises those deliverable on contracts. On the Chicago market, seventeen wheats of three varieties are now deliverable on contracts—seven at the contract price, four at premiums, and six at discounts. The number is smaller on the other markets. Details are shown in Appendix Table I for the four principal wheat markets of the United States. The third class of wheats, those not deliverable on future contracts, includes various inferior varieties and grades, also mixed wheats, variously sold on sample if sold from the farm at all.

The premium wheats are consumed largely in the United States in the manufacture of superior flour for domestic consumption, of which but a small amount goes abroad to special markets. Premium wheats are seldom exported nowadays, since importing countries can usually secure the same qualities in wheats from other exporting countries, without paying the premiums prevailing here. Wheats deliverable on contracts are used in the manufacture of standard American flours for domestic consumption, usually blended with premium wheats. Wheats of straight contract grade go more or less freely to export, especially winter wheats, durum, and Pacific wheats. Flours ground from wheats deliverable on contracts enter export markets more or less freely, according to the season. Wheats not deliverable on contracts go in part into export wheat, and in part are ground to some extent into flour for the export market, and may indeed be used sparingly in blends ground for the domestic market. Much of such wheat goes into feed.

It is important clearly to understand what is involved in the composition of the several flours. We have flours of pure type, i.e., ground from one type of wheat, though not necessarily from one variety of wheat within the type. Thus, we have hard spring-wheat flour, hard winter-wheat flour, and soft red winter-wheat flour. Hard spring-wheat flour is ground largely from Marquis wheat, but includes Fife and other standard varieties and may even include Kota and durum wheat. Hard winter-wheat flour is ground largely from Turkey Red or Kanred wheat, but may include Blackhull or other hard winter-wheat varieties. Less specified relations hold for soft red winter-wheat flour. Secondly, there are mixed-type flours, ground from blends of winter and spring wheats, varying from region to region and from season to season. These mixed flours are for some uses not so good or so uniform as pure-type flours; but for other purposes they may be quite as satisfactory. Flour millers, in short, blend varieties of wheat within the types of wheat and also blend the wheats of different types, in accordance with varying circumstances.

The miller makes his own blends, and he cannot use blends representing a cross section of the contract market. If a miller, under the seller's option, were to take deliveries on the Chicago market, he might receive any one or several or all of seventeen grades of wheat of three types, not alike in milling values in any two deliveries.

It is the general objective of mixing operations in terminal markets to secure the largest possible volume of wheat meeting the federal grades directly deliverable on contract. These may be termed basic wheats; in the price structure of a wheat crop, the premium wheats are superimposed upon this basis. There is, however, no such thing as comparable grades of flour, i.e., grades of flour representing each year the deliverable grades of wheat as they are mixed in terminals to meet the specifications of the federal grain act. In other words, there is practically no flour as of the grade of wheat, but most flours are blends from the grade standpoint; and a particular flour, even a high-grade flour, may contain varying amounts of wheats whose prices are as far apart as 50 cents a bushel. Flours produced remain fairly stable with respect to quality from year to year, but wheats produced do not.

The substantial variations in prices in a single market at a particular time, already mentioned, naturally encourage the mixing of wheats with a view to obtaining the best returns for the heterogeneous lots in hand; and similar considerations call for the exercise of keen judgment on the part of millers, who seek to obtain that combination of wheats from which they secure desired

flours which will yield the maximum net returns. Many millers prefer to select their wheats in the country or in the terminal market before wheats are mixed, and thus to make up their own combinations. Apart from this, the mixing of wheats to make the best of the specifications of the federal grades is well-nigh universal in this country, among wheat pools as well as commercial grain dealers; and it may be regarded as an inevitable consequence of variations in wheat and the existence of statute grain standards. In Canada such mixing is practiced by line elevators, farmers' elevators, and the pools; indeed one objective of the Campbell amendment to the Canadian Grain Act was to permit the growers to obtain the profits of terminal mixing. Just now, there is in Canada a conflict on policy, some desiring to limit mixing to wheats within the grade. It is against the practice of mixing wheat so as barely to make the grade ("skinning the grade," as it is sometimes termed in grain circles) that European importers have raised strenuous protests in recent years. But it is universal practice, when marketing a product under specifications, to meet the specifications but not to exceed them.

There is some inconsistency, however, between the efforts to secure full values for premium wheats and the efforts to secure full profits of mixing. The larger the amount of wheat sold on protein content and weight per bushel, the smaller the amount available to strengthen poorer wheats. The more that high-grade wheats are stretched with low-grade wheats in order to grade No. 2, for example, the less high-grade wheat will be available for sale on the sample market. The interests of grain dealers and of flour millers are frequently divergent and the mixing of wheats in terminals has driven many millers to country buying of wheat in the United States.

Selection for Study of Variations

Cash wheat quotations, though based since 1917 on the federal grades, are nevertheless of a conspicuously heterogeneous nature. For the experienced men of the trade it is not difficult to designate within the range those quotations that are of most significance. Though there is considerable difference of view between millers and grain merchants, agreement could probably be secured on the quotations to be regarded as representative in the commodity sense. Nevertheless, the fact that the reported closing cash price quotations on the Minneapolis Exchange represent the judgment of a price committee, whereas on the Winnipeg Exchange these correspond to quoted transactions, illustrates for this country the need for interpretation, even within the trade.

Cash prices may be either by sample and on test or of the grade. In a year of customary quality in Canada, the cash grain prices at Winnipeg represent elevator-run wheat, as of the grade, at Fort William and Port Arthur. In a year of sub-standard quality, such as 1928–29, notations also appear of selections within the grade, with occasional indications of premium on protein. In the American markets (disregarding Pacific and durum wheats) the amount of wheat sold in terminal cities as elevator-run of the grade is declining; more and more, specifications of quality are applied to the grade. This development is most pronounced on the Minneapolis market and for spring wheat in general; but it is becoming the established practice in the hard winter-wheat region. In the case of soft winter wheat, the regional and local variations are so pronounced that purchase by millers on sample is highly developed, though it rests on considerations other than protein content.

What is today to be regarded as representative practice in the hard wheat regions is to have the cash price quotations based on four factors: the federal grade of the type, the protein content, admixture of deleterious components, and the futures price of the day. As an illustration may be given the price range at Minneapolis on December 5, 1927, as expressed in the trade press, on wheat grading No. 1, based on protein, as follows, in terms of premiums over the December future:

14	per cent—	30	to	38	over December
13½	per cent—	25	to	32	over December
13	per cent—	20	to	26	over December
12½	per cent—	13	to	18	over December
12	per cent—	8	to	12	over December
11½	per cent—	3	to	6	over December

This illustration is rather extreme, even for spring wheat, and the range of prices within a grade is usually less for hard winter wheat than for hard spring wheat. The variations of 3 to 8 cents between wheats of the same protein content are the consequence of deleterious components or particular milling characteristics.

Under such circumstances, how shall one express statistically the price of cash wheat? On each market daily is a range of bids; at the close of each day are the reports of carlot sales at different prices. Obviously the sales constitute the most representative basis for the cash prices of the day. If for each market one obtains the sales by carload lots with the prices for each deal, one secures the weighted cash price of wheat for the day in that market.[1] The several markets in a region dealing with the same kind of wheat will exhibit somewhat varying prices for the same wheats, depending on circumstances of transportation and other factors. It is customary and convenient to select one market as representative of a type and region.

Minneapolis is the representative market for hard spring wheat. Into the other two prominent markets, Duluth and Chicago, pass the spring wheats that have filtered through the Minneapolis market. By this we mean that the millers buying on the Minneapolis market make the earliest appraisal of the characteristics of the oncoming flow of wheat and have the first selections from among the daily receipts; for the most part, what passes to Duluth and Chicago are the (flour) wheats that have failed to impress the Minneapolis buyers with their desirability.[2]

In the case of the hard winter wheats, Kansas City is the controlling market. Though from the milling point of view the interior markets, extending from Wichita south, may be regarded as more representative, nevertheless hard winter-wheat prices may still be best judged by the Kansas City quotations.

On the Kansas City market premiums for protein are quotable in six divisions, ranging from below 11.5 per cent to 14 per cent protein and above. In the second week of March 1929, in a season of low premiums for protein, the following prices for hard winter and hard spring wheats were quoted:

Percentage of protein	Kansas City	Minneapolis
14	4–7 cents over the May	15–20 cents over the May
13	1–3 cents over the May	5–10 cents over the May
12	2 cents under to the May	1 cent under to 1 cent over the May

In the case of soft red winter wheat, the choice lies between St. Louis and Chicago, with St. Louis at present the preferable market for cash quotations. Since nothing in soft red winter wheat corresponds, in reliability as a measuring stick, to protein content in the hard wheats, the cash prices for the different soft red winter wheats are not as comparable as are those for the hard wheats.

In connection with soft red winter wheat, it must be kept in mind that this crop runs much less true to type than do hard winter and hard spring wheats. In the hard spring-wheat crop, Marquis wheat is prominent; in the hard winter crop, Turkey Red and Kanred wheats are outstanding; no variety is correspondingly prominent in the soft red winter-wheat crop. Regional characteristics are prominent in the soft red winter-wheat crop; in the terminals this wheat is therefore usually of mixed varieties. Under these circumstances, the milling characteristics are less sharply defined; but at the same time, the proportion of the crop grading No. 2 is subject to wide variations.[3]

It is on the basis of considerations indi-

[1] Subject to the qualification that some cash sales are made out of elevators and from the country.

[2] To some extent, it is alleged in Montana, the Montana spring wheats do not meet with representative quotations in the cash markets of Minneapolis.

[3] The following situation existed in 1924, according to J. Allen Clark ("The Registered Varieties of American Wheat: Their Class, Origin, and Acreage," *Journal of the American Society of Agronomy*, November 1927, XIX, 953–1040): Of hard spring wheat, 39 varieties were registered, of which 20 were grown commercially; Marquis was the leading variety, followed by Kota, Preston, Ruby, Red Fife, and Bluestem. Of hard winter wheat, 26 varieties were registered, of which 17 were grown commercially; Turkey (Kharkof) was the leading variety, followed by Kanred, Blackhull, Michikof, and Minturki. Of soft red winter wheat, 85 varieties were registered, of which 58 were grown commercially; the leading varieties were Fulcaster, Fultz, and Poole, followed by Mediterranean, Trumbull, Leap, and others with about the same acreage.

cated above that we propose to use weighted averages of cash sales instead of bare quotations for cash wheat or wheat futures. Exporters purchase wheat on grade, but millers purchase wheat on flour values. There is of course a continuous interaction between the prices of wheat futures at home and abroad and the premiums and discounts on cash markets resulting from variations in milling quality. Wheat cannot be defined in a sentence, a grade cannot be stated in a word, and a price cannot be given in a figure. It is not inept to describe the price of wheat as a "no man's land" between the contending forces of supply and demand, which is continuously being pushed forward or forced backward and is widened or narrowed with variations in forces or tactics of the opposing price combatants.

The United States Department of Agriculture computes as representative of the respective wheats the weighted average prices per bushel of reported carlot sales of No. 1 Northern Spring wheat at Minneapolis, No. 2 Hard Winter wheat at Kansas City, and No. 2 Red Winter wheat at St. Louis. These figures go back to 1899, and constitute the most serviceable data now available. Since 1918–19 are also reported weighted average prices for combined markets; but for purposes of interpretation, it is better to use prices in the individual markets, because they are more homogeneous and extend back over a considerable prewar period.

It is to be emphasized that the weighted average prices of these important wheats at Minneapolis, St. Louis, and Kansas City since the war are not directly comparable with the corresponding weighted average prices covering the period 1899–1914. The grading has been influenced by the federal Grain Standards Act, which came into effect in 1917; the characters of the wheats have been changing, and despite introduction of improved varieties, signs of deterioration are everywhere in evidence; flour standards have changed over the past two decades, for the most part in response to changes in large-scale methods of making bread; premiums on protein were little known before the war; the range of prices of a variety of wheat on the cash grain market tends to be much wider since the war than it was before the war. All in all, the definition of a representative wheat, and the determination of its price, have become more difficult since the war. Nevertheless, the data selected are reasonably satisfactory for the purpose in hand.

The seven crop years from 1914–15 to 1920–21 constitute a period of abnormal price influences connected with the war, with radical shifts in the general level of prices. If we regard the post-war deflation of prices as having been completed with the crop of 1920–21 (that is, on June 30, 1921), there are but seven post-war years, ending with June 30, 1928, in which such extraordinary influences were absent. With these seven may be compared fourteen pre-war crop years, closing June 30, 1914. In view of all the circumstances, the pre-war period available is none too long; and the seven post-war years constitute a period so short as to enforce precaution in interpretation.

To supplement this material, and also to serve as a contrast, other price series seem desirable. Of the various series available, we have selected four. One is the American values of exported wheat. The declared value handed in by the exporter corresponds to the f.o.b. price of wheat, port of embarkation. Since the American prices for purposes of this study are primarily related to the European prices, we have used in this series only the prices of wheats exported to Europe.

Another series represents the average price per bushel of daily cash closing prices of No. 1 Manitoba Northern wheat at Winnipeg. This series does not extend back earlier than 1909, because of lack of closing cash quotations prior to that date. We have, therefore, available only a short period of five years before the war and the seven-year period 1921–28.

Finally, we employ two series of British wheat prices. The first series represents the average spot price per sixty-pound bushel of good average quality imported red wheat at Liverpool.[1] The second series

[1] It will be recalled that, outside of American and Canadian wheats which are purchased on grade, all wheat entering the United Kingdom is purchased in country of origin on sample or specification. The component wheats vary substantially in quality from season to season.

represents the declared values of imported wheats into the United Kingdom and is therefore a weighted average price of all wheats imported. Before the war, sterling and the dollar fluctuated very slightly in relation to each other; therefore the pre-war British figures have been converted into American currency at par. The British figures for that portion of the post-war period when sterling was depreciated have of course been corrected for fluctuations in exchange and the prices are therefore on terms of parity with the dollar.

The four American price series and the series of British import prices are weighted prices; the Winnipeg and the spot Liverpool prices are unweighted arithmetic averages of prices. Thus, the seven series are not strictly comparable; but for the purpose of comparison of month-to-month variations, it is improbable that any material error may thus have been introduced.[1]

IV. MONTH-TO-MONTH VARIATIONS

In the appraisal of wheat prices over a considerable period, the month represents the shortest time in which significant changes in the wheat price can be conveniently studied. The month-to-month variations, however, contain several components, and these should be carefully distinguished. Whenever the price level of a crop year changes from that of the previous crop year, such change is rarely sudden, though the transition may be step-like on one occasion and more precipitous on another. Within the month-to-month variation is also included the recurring seasonal price movement to be discussed below. If the seasonal movements and changes in the crop-year price level were both eliminated from consideration, there would still remain month-to-month fluctuations of greater or lesser magnitude, depending on circumstances. Sometimes, as we have observed, it is necessary to study the day-to-day fluctuations in order to appraise a month-to-month variation. In this section, however, we consider the month-to-month variations as they emerge from the price data we employ, without adjustment for inter-seasonal variations or elimination of the recurring seasonal movement.

Statistically, we are in position to view and appraise month-to-month variations on the basis of fairly representative material, because the official compilations of averaged prices of reported cash sales at the principal markets extend back to 1899. For reasons indicated in the preceding section, it seems best to use the monthly weighted average prices of reported cash sales of three representative wheats, namely, No. 1 Northern Spring at Minneapolis, No. 2 Red Winter at St. Louis, and No. 2 Hard Winter at Kansas City; and to study three seven-year periods—1900–07, 1907–14, and 1921–28. For supplementary series we have used the series of unweighted monthly averages of the Winnipeg prices of No. 1 Manitoba Northern since 1909, the series of unweighted monthly averages of good average quality imported red wheat at Liverpool, and the series of weighted average prices of wheats imported into the United Kingdom, since 1900. All of these latter are expressed in terms of American money.

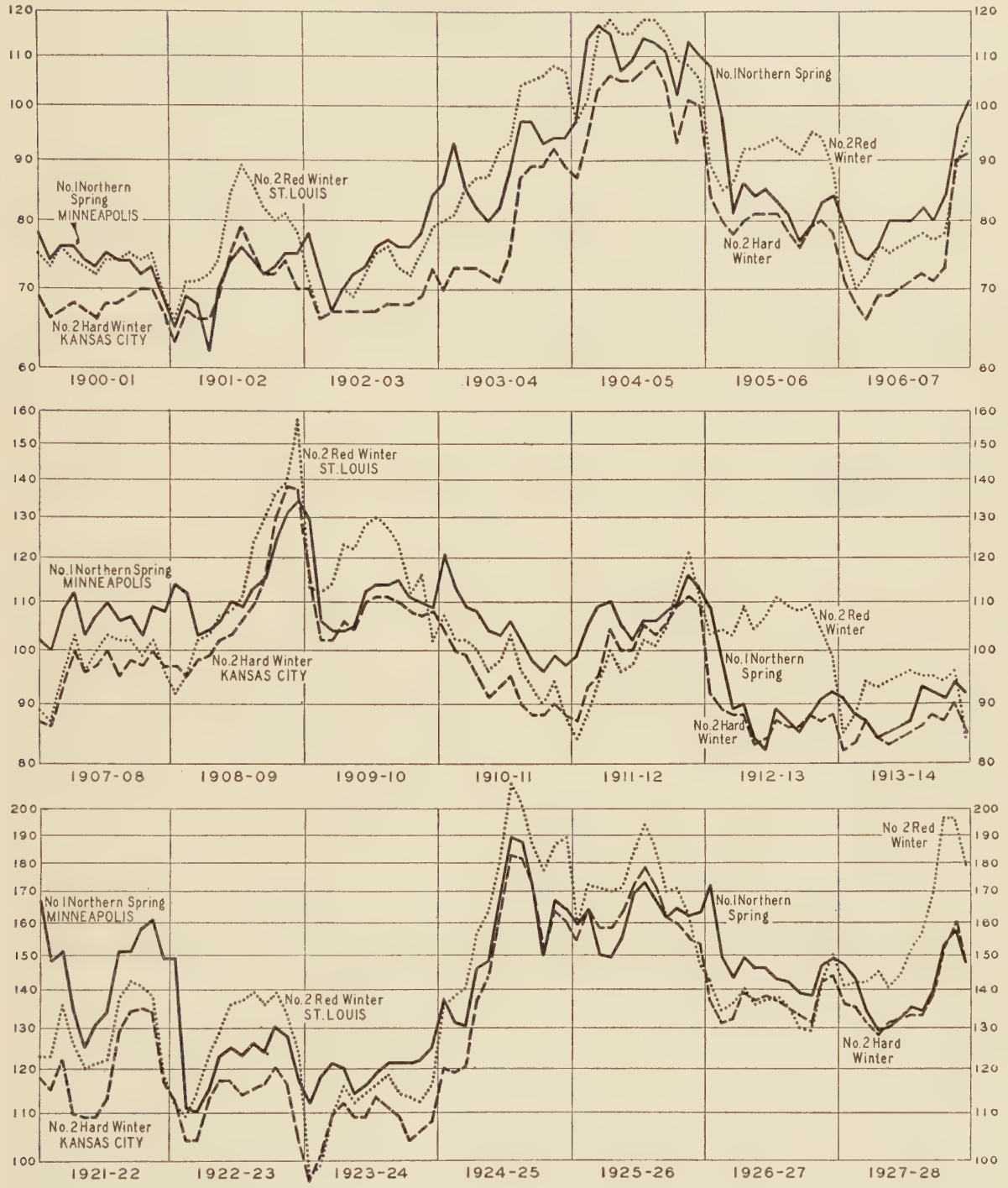
In considering month-to-month variations (i.e., from one month to the next) we use monthly average prices, as described. Later, in the consideration of year-to-year variations, we adjust yearly average prices for changes in the general price level. This might also be done for the study of month-to-month variations, by adjusting each wheat price of the month on the basis of the all-commodity wholesale price index number of the month. For the present purpose, this refinement seems unnecessary, since the adjustments would have only a slight effect on month-to-month variations.

The basic data are given in Appendix Tables II–VII. In Chart 3 we have presented the three American series in graphic form. A logarithmic vertical scale is used in order to render the variations comparable on different levels of prices. Since we

[1] The statistical material is contained in Appendix Tables II–VII. Of the seven series, the series of American export prices is not presented in the form of monthly data, since this series finds no use in the study of month-to-month variations.

CHART 3.—WEIGHTED AVERAGE PRICES OF REPORTED CASH SALES OF THREE REPRESENTATIVE WHEATS, MONTHLY, FROM JULY 1900 TO JUNE 1914, AND FROM JULY 1921 TO JUNE 1928*

(Cents per bushel; logarithmic vertical scale)



* Data in Appendix Tables II–IV.

are not here concerned with the course of wheat prices over the periods studied, no extended discussion of the chart is called for. It serves mainly as part of the back-

ground of the consideration of month-to-month variations. In passing, however, it is worthy of remark that the three series plotted show considerable divergence one from another.

The tables of monthly variations have been set up in the form of deviations of the price of one month from the price of the previous month. (Appendix Tables VIII–XIII.)

In using the tables of month-to-month price variations, it is to be kept in mind that these are useful for the study of variations but not for the study of values. The wheats involved are substantially different. The spot price of red wheat at Liverpool probably applies to wheat approximately comparable with No. 2 Hard Winter; but No. 1 Manitoba Northern is much superior to No. 1 Northern Spring, or to the average of red wheat at Liverpool, and is both superior to, and different in type from, No. 2 Red Winter wheat at St. Louis.

Comments on Variations Revealed

Both Chart 3 and the tables of deviations suggest, entirely in conformity with trade experience, that crop years may be divided into commonplace years and exceptional years. The exceptional years are characterized by wide changes in prices within the year, the result of crop scare or some particular untoward circumstance, or of marked change in the price level from one crop year to the next. Under such circumstances occur the wide month-to-month variations that are to be seen in the figures for 1904–05, 1905–06, 1908–09, 1909–10, 1921–22, 1924–25, 1925–26, and 1926–27.

Looking over the tables of variations in wheat prices on the American markets, one is struck with the relative indistinction of variations in the majority of months. But in each period were exceptional years displaying extreme variations in wheat price from one month to the next. The highest month-to-month variation in the first seven-year period was 17 cents (spring wheat, July–August 1904 and August–September 1905; and hard winter wheat, April–May 1907); in the second period it was 44 cents (soft red winter wheat, June–July 1909); and in the third period, 38 cents (spring wheat, July–August 1922).

Usually, but not always, wide deviations were simultaneously displayed at all three American markets. In the 84 months of the period 1900–07, the number of monthly deviations of 10 cents or more was five at Minneapolis, seven at St. Louis, and four at Kansas City. In the 84 months of the period 1907–14, the number of deviations of 10 cents or more was three at Minneapolis, eight at St. Louis, and four at Kansas City. In the 84 months of the period 1921–28, pronounced deviations occurred much more frequently than in the pre-war period; variations of 10 cents or more occurred seventeen times at Minneapolis, twenty-three times at St. Louis, and eighteen times at Kansas City. If one regards a deviation of 15 cents or more since the war as corresponding to a deviation of 10 cents or more before the war, the difference is still conspicuous; variations of 15 cents or more occurred eleven times at Minneapolis, fourteen times at St. Louis, and eight times at Kansas City in the post-war period.

When the frequency distributions of month-to-month changes in wheat prices are studied, no peculiarities deserving special attention are evident. As the data are presented in Table 3, it appears that zero changes are less common, relative to changes of 1 or 2 cents, upward or downward, than would ordinarily be expected, but this is a consequence merely of the fact that we have had to use figures in which fractions have been rounded off to even cents. Allowance being made for this fact, it appears that the smallest month-to-month changes are the most common, that the bulk of the changes fall within moderate limits, and that large changes occur only infrequently.[1] If attention be given to the direction of the changes as well as to their size, it appears that the large changes are somewhat more commonly negative than positive, but the tendency is slight. The distributions are found to approximate closely the so-called normal form. They differ from the normal chiefly in showing an excess of very large changes, the number of changes exceeding four times the semi-interquartile range being about twice that

[1] In general, these observations apply to the variations in the other price series presented in Table 6.

TABLE 3.—NUMBER OF MONTHS SHOWING INDICATED CHANGES ABOVE OR BELOW PRICE OF PREVIOUS MONTH, OF NO. 1 NORTHERN SPRING WHEAT AT MINNEAPOLIS, NO. 2 RED WINTER WHEAT AT ST. LOUIS, AND NO. 2 HARD WINTER WHEAT AT KANSAS CITY, 1900–07, 1907–14, AND 1921–28*

Change above or below previous month (*cents*)	No. 1 Northern Spring wheat at Minneapolis			No. 2 Red Winter wheat at St. Louis			No. 2 Hard Winter wheat at Kansas City		
	1900–07	1907–14	1921–28	1900–07	1907–14	1921–28	1900–07	1907–14	1921–28
0	8	3	5	6	3	3	18	7	6
1	13	21	10	29	17	14	21	23	14
2	24	15	13	10	7	7	12	15	11
3	7	11	13	14	12	9	14	11	7
4	11	14	3	7	11	7	9	11	8
5	5	2	6	6	8	4	1	6	5
6	4	6	10	4	9	4	1	3	5
7	2	3	1	1	3	4	2	2	3
8	3	2	1	..	4	3	1	1	4
9	2	4	5	..	2	6	1	1	3
10	1	..	..	2	1	4	..	..	3
11	1	1	1	2	1	..	1	..	1
12	1	1	2	..	1	..	1	1	4
13	..	..	..	1	1	5	..	..	1
14	..	..	3	1	2	..	..	..	1
15	..	..	..	..	..	2	..	1	..
16	..	..	2	1	..	4	1	..	2
17	2	..	3	..	..	1	1	1	2
18	..	..	1	..	1	..	..	..	..
19	..	..	1	..	..	1	..	..	1
20	..	..	..	..	..	1	..	..	3
Over 20	..	1	4	..	1	5	..	1	..
Total	84	84	84	84	84	84	84	84	84

* Based on data in Appendix Tables VIII–X.

to be expected in a strictly normal distribution.

The more important facts to be gathered from a study of the month-to-month changes are most readily observed in the averages. Table 4 shows the average month-to-month price change for each class of wheat in each of three seven-year periods.

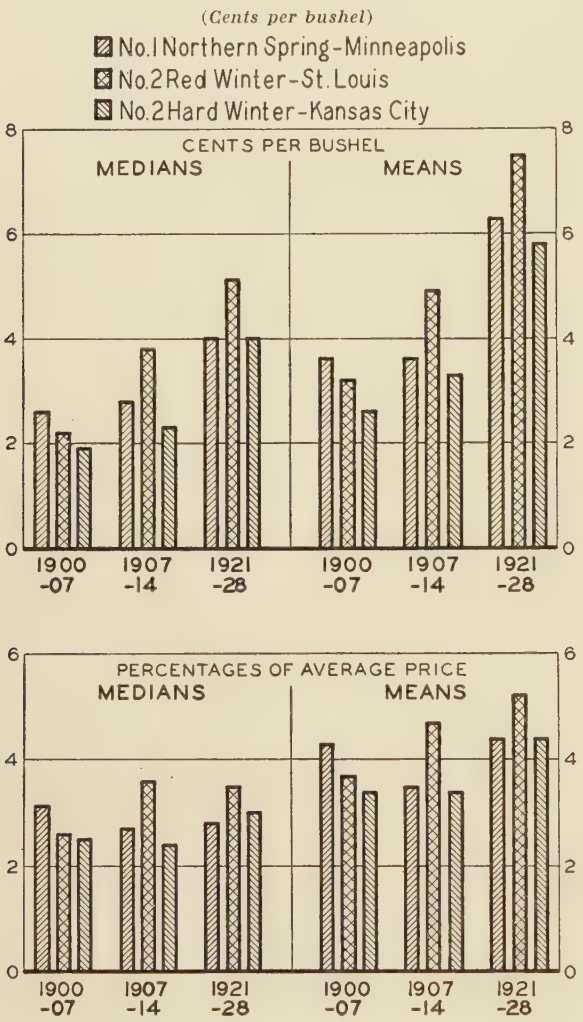
TABLE 4.—AVERAGES OF MONTH-TO-MONTH CHANGES IN WHEAT PRICES, BY PERIODS AND BY CLASSES OF WHEAT*

Changes	1900–07				1907–14				1921–28			
	No. 1 Northern Spring Minneapolis	No. 2 Red Winter St. Louis	No. 2 Hard Winter Kansas City	Average	No. 1 Northern Spring Minneapolis	No. 2 Red Winter St. Louis	No. 2 Hard Winter Kansas City	Average	No. 1 Northern Spring Minneapolis	No. 2 Red Winter St. Louis	No. 2 Hard Winter Kansas City	Average
Median change (*cents per bushel*)	2.6	2.2	1.9	2.2	2.8	3.8	2.3	3.0	4.0	5.1	4.0	4.4
Mean change (*cents per bushel*)	3.6	3.2	2.6	3.1	3.6	4.9	3.3	3.9	6.3	7.5	5.8	6.5
Average price (*cents per bushel*)	83.9	85.5	77.2	82.2	103.4	104.3	97.4	101.7	142.1	143.8	132.5	139.5
Median change (*per cent of average price*)	3.1	2.6	2.5	2.7	2.7	3.6	2.4	2.9	2.8	3.5	3.0	3.2
Mean change (*per cent of average price*)	4.3	3.7	3.4	3.8	3.5	4.7	3.4	3.8	4.4	5.2	4.4	4.7

* Based on data in Appendix Tables II–IV and VIII–X.

Chart 4 shows these graphically. Both the arithmetic means of the changes and the medians are shown. In the upper part of Chart 4 the averages are shown graphically. Because of the appreciable number of exceptionally large changes, the medians probably constitute a somewhat more stable and trustworthy form of average than the arithmetic means. The general showing of both types of average is similar, however, each supporting the other as evidence.

CHART 4.—AVERAGES OF MONTH-TO-MONTH CHANGES IN WHEAT PRICES, BY PERIODS AND CLASSES OF WHEAT*



* Data in Table 4.

These averages reveal clear differences in price variability between the three wheats in the United States markets. In each period and judged by either average, the smallest variability is shown by No. 2 Hard Winter wheat at Kansas City. Only in one case does another wheat show equally low variability: the median change (but not the mean) for No. 1 Northern Spring wheat at Minneapolis in 1921–28 is the same as for No. 2 Hard Winter at Kansas City. In the last two periods, judged by either average, the greatest variation is shown by No. 2 Red Winter wheat at St. Louis. In these two periods, No. 1 Northern Spring at Minneapolis resembles No. 2 Hard Winter in respect to variability more than No. 2 Red Winter. In the first period, 1900–07, No. 1 Northern Spring shows the greatest variability, with No. 2 Red Winter standing midway between No. 1 Northern Spring and No. 2 Hard Winter.

The month-to-month price variability of the three wheats as thus shown stands roughly in the same relation as their price levels. The last two lines of Table 4 and the lower portion of Chart 4 show the measures of variability expressed as percentages of the average prices for the periods. It is clear from these that the differences in level of prices of the three wheats only in small measure account for the differences in variability. In terms of percentage of average price, the variability of No. 2 Hard Winter stands relatively somewhat higher than before, so that for the period 1921–28 it appears slightly greater, when judged by the medians, than the variability of No. 1 Northern Spring. For the two earlier periods No. 2 Hard Winter still shows the smallest variability among the three wheats. No. 2 Red Winter still stands highest in respect to variability in the last two periods and No. 1 Northern Spring highest in the first period.

The variability, period by period, is most conveniently studied in terms of averages for the three classes of wheat. For the period 1900–07 the medians of month-to-month changes for the three classes of wheat average 2.2 cents; for 1907–14 the average is 3.0 cents; for 1921–28 the average is 4.4 cents. Little significance can properly be attached to such averages individually, but their relations, one to another, are worthy of some attention and furnish one convenient indication of the variability of

wheat prices period by period. Substantially the same picture is given by the averages of the arithmetic means, which are, in order for the three periods, 3.1, 3.9, and 6.5. As one considers the variability in prices of each grade from period to period, there is found no case of decreased variability in a later period. The means show No. 1 Northern Spring as variable in 1907–14 to the same extent as in 1900–07. Even in this case an increase in variability in the later period is shown by the medians.

The progressive increase in month-to-month price variability from 1900–07 to 1921–28 seems roughly proportional to the increase in the level of wheat prices from period to period. When the measures of variability by periods are expressed as percentages of the average prices for the periods, as in the last two lines of Table 4, the regular increase in average variability of each wheat from period to period disappears. No. 1 Northern shows its greatest variability in the first period, if judged by the medians; in the last period, if judged by the means. No. 2 Red shows its greatest variability in the second period, if judged by the medians; in the last period, if judged by the means. No. 2 Hard shows its greatest variability in the last period, whether judged by medians or means. The medians probably furnish the more reliable basis for judgment. They suggest that the price variability of No. 1 Northern, expressed as a percentage of the average price, was greatest in the period 1900–07 and has since been less; that the price variability of No. 2 Red Winter was low in the period 1900–07 and has since been greater; and that the price variability of No. 2 Hard increased in 1921–28 considerably above that shown in the two previous periods. These differences in variability from period to period are not great, however, and may not be regarded as more than suggestive. Certainly the data offer no support to any theory that the variability of wheat prices expressed as a percentage of the price has changed greatly since 1900.

Some semblance of uniformity appears in the seasonal distribution of the month-to-month variations. In the winter wheats the largest month-to-month price changes tended to occur between June and July, excluding the exceptional years; in the case of spring wheat at Minneapolis, the largest change from month to month tended to occur from July to August, and at Winnipeg, from August to September. These changes are usually downward, as one might expect from the recurring seasonal movement discussed below, and are characteristically due to the transition from one crop year to the next, complicated as it is by trading difficulties, the influence of futures, and uncertainties as to the size of the carryover as well as of the crops in process of harvesting. In May also was displayed occasionally a tendency to sharp price variation.

The month-to-month price variations are apt to affect one kind of wheat more than the other. They emphasize again the importance of analyzing, in each crop year, the regional as well as general circumstances attending month-to-month price variations. It is important, in the case of wide month-to-month variations, to determine to what extent these are synchronous with corresponding variations in foreign markets and thus related to international rather than to domestic influences.

The distribution of high and low prices throughout the crop year may also be illustrated over a longer period, with the use of the records of the Chicago Board of Trade. Over the forty-year period ending in 1914, Table 5 (p. 260) gives the number of times each individual month showed the extreme price—the highest or lowest single day's price of the year.

These data illustrate at once the tendency to a recurring relationship, and also the pronounced occurrence of irregularity. May showed the largest number of highest single day's prices, April showed the second largest. Not once in the forty years did March show the highest single day's price of the year; July and November each showed it once. July, August, and October showed the largest number of lowest single day's prices. May showed not once the lowest single day's price of the year; June and September each showed it once. A rather surprising occurrence was the fact that, over the period, high prices were more frequent, and low prices less frequent, in September than in August and October.

The available prices at Winnipeg unfortunately cover only five of the pre-war years. A fairly close parallelism with Minneapolis is to be observed, but the variations in Winnipeg for the post-war period average 30 per cent larger. The median month-to-month change is 5.2. This compares with a median month-to-month change at Minneapolis of 4.0 for the same period and a median of 5.1 for No. 2 Red Winter at St. Louis.

TABLE 5.—INCIDENCE OF EXTREME PRICES OF CONTRACT WHEAT IN CHICAGO, 1875 TO 1914*

Month	Number of times that highest price of year occurred in month indicated	Number of times that lowest price of year occurred in month indicated
January	3	6
February	4	2
March	0	2
April	7	3
May	8	0
June	4	1
July	1	7
August	2	7
September	5	1
October	4	7
November	1	2
December	5	4

* Data from *Seventieth Annual Report of the Trade and Commerce of Chicago* (Chicago, 1928), p. 89.

In the case of the spot prices of imported red wheat at Liverpool, we have figures covering the three seven-year periods, though data for a number of months are missing from the series; for the crop year 1904–05 only three month-to-month changes are available. The month-to-month variations in the Liverpool market before the war were as a whole substantially narrower than in the American markets. The median month-to-month change of good average quality red wheat at Liverpool for the first seven years was only 1.4 cents, as compared with medians of 2.6, 2.2, and 1.9 in the three American markets. The relatively higher variation in American markets was a consequence chiefly of the short United States crop of 1904, in the face of an ample world crop, which placed the United States near a domestic price basis. For the period 1907–14 the median change at Liverpool was 2.3 cents, just equal to the median price change for No. 2 Hard Winter at Kansas City and below the medians for the two other United States markets. Not once during the 1900–07 period did the month-to-month variation in Liverpool equal or exceed 10 cents and such a variation occurred only once during the 1907–14 period.

Since the war, however, the month-to-month variations at Liverpool have been about as wide as on the two most variable North American markets. For illustration: in July 1924 the price was 17 cents above that of June and rose again 17 cents in August; in March 1925 the price fell 16 cents from February and declined 23 cents more in April; in July 1925 the price declined 6 cents, rose 12 cents in August, declined 8 cents in September, declined another 14 cents in October, then rose 5 cents in November and 18 cents more in December. The median change of good average quality red wheat at Liverpool for this period was 5.1 cents, as compared with 5.2 cents at Winnipeg, 5.1 cents at St. Louis, and 4.0 cents at both Minneapolis and Kansas City.

For convenience the medians of month-to-month price changes for red wheat at Liverpool may be tabulated as follows in cents per bushel, together with other medians not previously shown in Table 4 (p. 257):

	1900–07	1907–14	1921–28
Good average quality red wheat at Liverpool	1.4	2.3	5.1
British imported wheat	1.0	1.4	3.2
No. 1 Manitoba Northern wheat at Winnipeg	...	...	5.2

Though the month-to-month variations in the declared values of import wheats in the United Kingdom are not comparable with the month-to-month variations on the spot wheat market, on account of lags in the flow of exports and the nature of the reports under the official regulations, nevertheless they present suggestive indications. The medians of month-to-month changes for British import prices, as shown in the tabulation above, run quite uniformly below the median changes for good average quality red wheat at Liverpool, being slightly over 70 per cent of the latter in the first period and slightly over 60 per cent of the latter in the two subsequent periods.

If the price series for red wheat at Liverpool were complete for the first period the median change for that series would undoubtedly be raised, quite possibly enough to show the variability of the import price series to be only about 60 per cent of that for the Liverpool series in this period as in the two later periods.

however, that the concentrating dependence of Great Britain on North America for her wheat supplies tends definitely to increase the variability of British wheat prices.

The British import prices in a sense correspond to the level of a reservoir, which does not rise or fall as rapidly as the streams that enter it. In a similar sense,

TABLE 6.—NUMBER OF MONTHS SHOWING INDICATED CHANGES ABOVE OR BELOW PRICE OF PREVIOUS MONTH, OF GOOD AVERAGE QUALITY RED WHEAT AT LIVERPOOL, BRITISH IMPORTED WHEAT, AND NO. 1 MANITOBA NORTHERN WHEAT AT WINNIPEG, 1900–07, 1907–14, AND 1921–28*

Change above or below previous month	Good average quality imported red wheat at Liverpool			British imported wheat			No. 1 Manitoba Northern wheat at Winnipeg		
	1900–07	1907–14	1921–28	1900–07	1907–14	1921–28	1900–07	1907–14	1921–28
0	16	11	9	24	15	7	..	..	4
1	26	18	7	32	28	14	..	..	11
2	13	12	7	18	19	15	..	..	8
3	6	17	6	6	8	11	..	..	10
4	2	7	5	2	5	4	..	..	5
5	6	4	8	1	5	6	..	..	5
6	3	4	6	1	1	7	..	..	5
7	1	3	3	..	1	5	..	..	6
8	..	1	1	..	1	2	..	..	3
9	..	3	3	..	1	2	..	..	7
10	..	..	4	..	..	4	..	..	1
11	..	..	2	..	..	1	..	..	2
12	..	..	3	..	..	..	..	..	..
13	..	..	1	..	..	3	..	..	1
14	..	..	1	..	..	..	..	..	1
15	..	..	1	..	..	..	..	..	3
16	..	..	2	..	..	2	..	..	..
17	..	..	4	..	..	..	..	..	..
18	..	..	1	..	..	1	..	..	3
19	..	..	..	..	..	..	..	..	..
20	..	1	..	..	..	..	..	..	1
Over 20	..	..	5	..	..	..	..	..	8
Total	73	81	79	84	84	84	..	..	84

* Based on data in Appendix Tables XI–XIII.

It is noteworthy that both series of British wheat prices show a greater increase in variability in the post-war period over the pre-war period than do the United States series. This relative increase in variability of the British series is in part a consequence of the disturbance in the international exchanges while England was off the gold standard, and in part a consequence of the high and variable freight rates and the interruption of the flow of wheat incident to the British coal strike of 1926. The variability of British wheat prices accordingly may not be expected to remain at such a relatively high level. It may well be,

the American export price would be expected to display less variation from month to month than is to be observed on the terminal markets. For both sets of figures, the weighting serves to smooth the curve of prices. Also, it is obvious that the month-to-month fluctuations in export values of wheat going to Europe from the United States would be expected to be larger than the month-to-month values of all wheat entering Great Britain. The British weighted import values ought to be about the stablest wheat prices in the world and relatively the lowest. A comparison of the declared monthly wheat values with the monthly

spot prices at Liverpool confirms this. Over the year, except under extraordinary circumstances, the month-to-month import wheat price per bushel in Great Britain is significantly stable.[1]

No appraisal of month-to-month price fluctuations, strictly construed, is possible unless changes in the wheat price level are taken into account. Fluctuations in price from month to month may be entirely the expression of change in the price level, they may be movements around the unaltered price level, or they may partake of both. Price fluctuations attending change in the price level tend to be relatively extreme. Of the periods here under review, the seven years since the war contain the more pronounced changes in wheat price level. Occasionally, with the use of month-to-month variations a significant change may be obscured. Thus, the price may fall or rise from the middle of one month to the middle of the following month, to be only partially reflected in the monthly prices. Sometimes a price movement may be better judged by weeks than by the month or by the quarter than by the month. This serves merely to enjoin the student of prices not to stick too closely to the use of any set interval of time.

Deviations from Annual Averages

The variability of wheat prices may be judged in terms of deviations from annual averages as well as in terms of the month-to-month changes studied in the previous section. Three distinct types of price variation may be looked for in any price series, and are reflected in measures of variability. Price variations may be quite irregular from month to month, a rise in one month being as often followed by a drop in the next month as by a rise in the next month, and vice versa. In a second type of variation it will be observed that price changes, once initiated, tend to continue through several months; an increase in one month is more likely to be followed by an increase in the next month than by a decrease, perhaps likely to be followed by an increase in several successive months. In the third type of variation an increase in one month is more likely to be followed by a decrease in the next month than by an increase; there is a distinct tendency to alternation in direction of changes.

The price curves characteristic of the three types of variation may be described as, for the first, entirely irregular, for the second, showing a distinct tendency toward trends running through two or more months, for the third, presenting a saw-tooth appearance.

Three price series showing the same variability when judged by averages of month-to-month changes may show quite different variability when judged by averages of monthly deviations from annual averages, if they represent variabilities of different types. If three series, equally variable when judged by month-to-month changes, show variation of the first, second, and third types, respectively, a calculation of variability in terms of deviations from annual averages will show the second series more variable than the first, and the third series less variable than the first. In the extreme cases the measures in terms of deviations from annual averages may show the second series twice as variable as the first, the third series only half as variable as the first, though in terms of month-to-month changes they appeared equally variable.

We cannot here enter into a detailed study of the type of variation shown by wheat prices. It is apparent from a brief study of the data that the variation of wheat prices is close to that of the first type. Periods will be found in which an upward or downward movement continues through several months, as is generally observed in variations of the second type. Periods will also be found in which the curve presents a saw-tooth appearance characteristic of type 3. But one cannot tell in advance whether a period will show the one or the other type of variation or neither. This is precisely what is to be expected with the irregular variations of type 1. The nature of the wheat market, furthermore, is such as to lead one to expect irregular variations. If it were demonstrated that wheat prices showed a variation other than that of

[1] "Liverpool prices are more closely related to the amount of wheat directly at the disposal of western Europe (west-European production plus imports) than to the world production." V. P. Timoshenko, *Wheat Prices and the World Wheat Market* (Cornell University Agricultural Experiment Station Memoir 118), December 1928, p. 87.

type 1, it would be demonstrated that the wheat market works very badly indeed.

Our present problem is, then, merely to measure variability of prices of different wheats in different markets and in different periods, on the assumption that we have to deal with variations of a quite irregular type, such that the change in one month cannot be predicted from the change in the previous month. We have merely to decide whether the month-to-month changes or the deviations from annual averages provide a more trustworthy basis for judging this type of variation. For this purpose the month-to-month changes are clearly to be preferred. They are much less affected by peculiarities of individual years or groups of years in which prices happen to show marked trends over periods of several months, or in which there happens to occur a series of alternations in month-to-month changes.

Causes of Variations

The effective causes of wheat price fluctuations (outside of the carrying costs) range themselves rather naturally into several groups. Whatever their nature, such causes attain their effects by determining the withholding, and the buying or selling of cash wheat or wheat futures. It is impossible discriminatingly to appraise the relative effects of a series of coexisting and overlapping influences; therefore, it is always somewhat hazardous to ascribe a particular fluctuation directly to a particular cause. Under certain circumstances, however, the relation between cause and effect is obvious.

The first group of causes that produce wheat price fluctuations express relations of domestic supply and demand for actual wheat. The quantity available for a crop year is a major factor determining the broad level of wheat prices for the year. A change in governmental report of yield, heavy or light marketing from the country, reports of accumulation or shortage in terminals in a region, heavy or light buying by mills, a shift in the visible supply or in the amount of wheat afloat, greater or lesser buying by exporters—these illustrate the factors in relation of supply to demand that tend promptly to influence the price of wheat over periods of days, weeks, and months. The more comprehensively the various items of supply and demand are covered, the more accurate the report and the more widespread the dissemination of such information, the easier it becomes to forecast the influence of physical supply and effective requirements as factors on price.

Statistical data, however, are more or less incomplete, out of date, and relatively untrustworthy. The well-informed judgments of experienced traders form a body of opinion that is likely to find a more or less concordant expression in the buying or selling of wheat futures, and in transactions in cash wheat. Such opinions sometimes rest on advance information of physical factors. Trade opinion may support crop reports or controvert them. Grain houses maintain private statistical services whose activities lie as much in the dissection of intelligent opinion as in compilation of data. Occasionally the grain exchanges are invaded by nothing less than an army of amateur speculators, usually bulls, whose transient and emotional opinions for the time being overwhelm the opinions of professional speculators and merchants.

There is next the corresponding body of information on supply and demand in the world. This information tends to lag and is in part less accurate, but none the less important in bearing on domestic price variations.

An important group of factors involving fluctuations in wheat prices includes new developments in the wheat crops, or other crops, and also to some extent new developments of a political and economic character that indirectly promote price changes. In every month of the year, somewhere in the world among the importing or exporting countries which trade on the international wheat market, wheat is being planted, is holding its own in condition or losing or gaining, and is being harvested.[1] The influence of weather reports on price is in the main, at least early in each situation, the result of opinion rather than of record. Weather changes provoke scares of crop failure in a sense in which they do not provoke scares of bumper crops. Just as the

[1] There is, however, a midwinter period in which relatively few changes occur.

developments in the different wheat regions of the United States affect domestic wheat prices, and through them international wheat prices, so the successive developments in other countries affect their domestic wheat prices, through them the international wheat prices and through them our domestic wheat prices. These developments may come to light through the media of trade information or through official channels. In international trade, expert opinion is often, perhaps usually, in advance of official reports. In some countries, like Argentina, there is little else than professional opinion available. The more comprehensively such information on crop developments comes in from the world at large, the more accurate the information and the more widely disseminated, the easier it is for expert trade opinion to judge of the influence on prices of wheat in this country. Crop developments at home and abroad provoke short-term fluctuations, influence the month-to-month variations, and exaggerate or diminish the seasonal movement. They tend to produce shifts in price level of wheat, and in consequence modify the price relations attending transition from one crop year to another.

Various influences outside of the domain of wheat may influence wheat prices. The course of prices of other grains is one of them. Numerous incidental and accidental factors may provoke short-term fluctuations. Changes in money rates, foreign exchanges, shipping charges, prospects for legislation, and elections at home or abroad are illustrations. Such external factors may exert pronounced influence, but more often the import is exaggerated. Whenever an obvious influence is not visible, imagination in the trade conjures up factors.

Lastly, we come to speculation. Trading in contracts for future delivery is a practice based on price variation. Broadly considered, the effect of speculation is to distribute risks and carrying charges, which tends to stabilization of price. But locally considered, speculation depends on price fluctuation, since speculators enter the market to buy at one level and sell at another.[1] The influence on wheat prices of speculation in wheat futures is a subject on which we do not plan to enter here. Proponents and opponents of speculation in wheat futures agree that it influences prices; they disagree as to whether such influence is of benefit or of injury to wheat growers. There is considerable to be said for the view that speculation often merely accelerates price changes already under way in consequence of determinable influences.

V. THE RECURRING SEASONAL PRICE MOVEMENT

Among the intra-seasonal price variations is one type, often obscured by others and yet underlying them, which may be termed the recurring seasonal price variation. We refer to the tendency of wheat prices, following the harvest, to rise by gradual increments to a high point before the succeeding harvest. Such a recurring seasonal movement of a fairly characteristic form is of course not peculiar to wheat; it is observed with other grains and also with many other commodities which are produced within a restricted season but marketed and consumed throughout the year—and indeed with certain others as well. Such a tendency occurs in every wheat-growing country of importance; but the onset and culmination vary in the different countries according to differences in harvest periods and other factors. Whether or not it occurs on the international market is quite another matter.

Carrying Charges

The fundamental basis of this tendency lies in the cost of holding or "carrying" wheat. Harvested in each country within a few weeks or months, wheat is milled or exported throughout the year, and is finally consumed quite evenly throughout the year. Portions of the crop must, therefore, be carried for shorter or longer periods by growers, middlemen, or millers. On some wheat rest only two or three months' carrying charges, on other wheat rest the carry-

[1] As a part of speculation must be assigned the price influences of current grain storage conditions in terminal markets. Cf. B. F. Goldstein, *Marketing: A Farmer's Problem* (New York, Macmillan, 1928), pp. 231 ff.

ing charges of eight or nine months, or the full crop year. Wheat is a durable good, but it requires appropriate storage if it is not to deteriorate; commonly, storage involves one or more additional handlings; the wheat must be insured; it represents an investment involving a cost for interest. There is no commercial motive in holding wheat in quantities beyond those required for current operations of millers and merchants, except occasionally for high-quality wheat, unless the price broadly tends to rise each month by an increment sufficient to cover the effective carrying expenses.

When the wheat grower has completed his harvest, as a rule he needs ready money, he does not wish to bear the carrying expenses, he prefers to avoid extra handlings and risks of injury to his grain, he does not wish to continue investment in a harvested but unmarketed crop, and he desires to avoid the ever-possible risk of a low price later as a result of abundant harvests elsewhere. In practice, the burden of carrying wheat is shared, in proportions that vary from year to year, by wheat growers, grain dealers, and flour millers. Dealers and millers regularly hedge all wheat held, and in effect the burden of carrying wheat is thus shared by speculators in wheat futures.

The gross carrying expenses fall into two groups—those relating to the physical plant of storage and those connected with the grain itself. In the elevators and warehouses and their contained equipment lies an investment; these are usually leased to the elevator men by their owners and to the appropriate return on the investment must be added insurance and provision for depreciation and upkeep. The wheat must be elevated (possibly several times), and conditioned (possibly several times), and there must be provision for interest and insurance on the wheat. These several items, related to the physical plant and to the wheat, vary somewhat from region to region and from time to time. Interest on the money in the wheat varies with the rate on commercial paper. Insurance rates vary with the construction of the elevator and the value of the wheat. Elevator charges, including unloading in and loading out with ten days' storage, are now 1¼ cents per bushel at Chicago and $\frac{1}{20}$ of one cent per bushel per day thereafter. Thus, the first month's carrying charge in Chicago averages around 3 cents a bushel on $1.20 wheat, and thereafter 2¼ cents a bushel. The charges in other terminals are commonly lower than in Chicago.

The recurring seasonal price variation corresponds to the monthly increment necessitated by the cost of carrying the wheat. If the copper supply of a year were mined in a month, other things being equal, the price of copper in each month following the mining month would rise by an amount corresponding to the handling charges and interest on the money invested in the metal. Similarly, other things being equal, the price of wheat in any region ought to rise each month by an increment representing the carrying charges of the month. These carrying charges are not represented by a constant rate, but may be thus treated as a straight line, as was done by the Federal Trade Commission, without serious misconstruction.

What we term the recurring seasonal price variation is, in the case of wheat (unlike eggs, for example), far from being a dominant or even a prominent factor in the crop-year price movement. The latter includes the recurring seasonal price variation, but also the results of the influence of other more or less predominating factors. These are, notably, the size of the harvest, the course of shipments from country and receipts at terminals, position of visible supplies, the milling demand, the prices of other grains, the rate of export, and the behavior of futures. Whenever the wheat price level shifts greatly from one crop year to the next, the transition is attended with additional variations in the crop-year price movement. These various factors tend to elevate or depress prices; their effects are added to the recurring seasonal price variation in some years and subtracted from it in others. The recurring price variation is a fairly constant variable; the other named factors are quite inconstant both as to occurrence and extent. In many crop years, the wheat price toward the close of the season stands above that near its beginning by the amount of the carrying charge, or within a few cents of it,

above or below. In exceptional years, on the other hand, the price in May will exceed the price in the preceding August by several times the carrying charge; or the price in May may be substantially below the price in August without any apparent reference to the carrying charge.

These considerations suggest the reasons why it is difficult statistically to isolate from actual price data the recurring seasonal element. The usual methods of deriving indexes of seasonal variation make use of devices for canceling out other factors than those of a recurring seasonal character. In the case of wheat prices the relatively large influence of factors other than the seasonal renders the results of this procedure of questionable value; and there is the further difficulty that, as with many other commodities, there may be significant changes in the seasonal factors over periods of years sufficiently long to yield an approach to effective cancellation of other factors.

Study by Federal Trade Commission

The Federal Trade Commission in its Report on The Grain Trade gave attention to the seasonal movements of grain prices, which it termed "the annual price cycle." The views of the Commission may be found expressed in the following quotations:

The annual price cycle.—It appears that there is a well-defined annual cycle in the curve of cash-grain prices, characterized by a comparatively low price immediately after the harvest, a gradual increase in price to a comparatively high point some time in the spring, and then a rather rapid falling off in price to a comparatively low level for the new crop. Unfortunately the grain is in the hands of the producer immediately after the harvest, when prices are generally lowest, and the producer has parted with it at the time when prices are highest, so that the gain from the increase in prices is likely to go chiefly to grain merchants or to speculators.

It is, of course, true in many individual years that there is not an advance in prices from the fall to the spring, and oftener still that there is an absence of a sharp falling off in price between the last month of the old crop year and the first months of the new crop year. It may be that the new crop is smaller than the previous crop, and, therefore, that prices remain high or even increase at the time of the year when there is ordinarily a decrease in prices.[1]

It will be observed that the lowest average price for wheat at Chicago occurs in August and the highest in May. The steps between these extremes are not absolutely regular, there being small recessions in November and March, but the general seasonal variation of prices is quite definite and its character unmistakable.[2]

Conclusions.—A definite seasonal cycle appears in the fluctuation of the monthly average prices for each of the five grains. It is perhaps better defined for rye, corn, and oats than for wheat. It is least well defined for barley. The degree of lack of regularity for wheat is due largely to the separation of winter and spring crops tending to cause a double cycle. It may also be affected by Southern Hemisphere shipments. Wheat is an article of world production and commerce to a greater extent than other grains, with almost uninterrupted increments of supply, though irregular in size and in time of harvest, accruing throughout the year.

The annual cycle corresponds rather closely to the crop years of the various cereals in the Northern Hemisphere, but there is a marked lag of prices in their response to the harvest. The lowest price is reached not immediately after harvest, but after more or less of an interval, during which the flow of grain to the terminal market is at its height. The highest price is reached some time before the next crop is gathered, commonly in May, but sometimes in the very last month of the crop year. The decline of the price may be accelerated or counteracted by what is known of the condition of the approaching crop. The situation at the close of the year is also affected by the preference of millers for old-crop wheat.[3]

The Commission undertook to measure the seasonal variation, using the spot prices reported by the Chicago Board of Trade for contract grade wheat, choosing whichever was cheapest of northern spring, red winter, and hard winter wheat. The daily prices were averages of the high and low quotations; the monthly averages were means of the daily prices; the annual prices were means of the twelve monthly prices. In order to obtain an approximation to the seasonal variation, average prices for successive January's, February's, etc., were prepared for the thirty-year period, 1886–1916, and also for three ten-year periods, presumably on the assumption that non-seasonal influences would cancel out and leave the seasonal movement revealed.

The tabular material of the Commission, rearranged into one table, is contained in

[1] Federal Trade Commission, *Prices of Grain and Grain Futures* (Report . . . . on the Grain Trade, Vol. 6), 1924, p. 6.

[2] *Op. cit.*, pp. 66–67.

[3] *Op. cit.*, p. 73.

Table 7. Striking is the difference between the seasonal variation, from August to May, in the three ten-year periods. The Commission remarked that these differences were misleading. During the first ten-year

TABLE 7.—AVERAGE MONTHLY PRICES OF CASH WHEAT AT CHICAGO*

(*Cents per bushel*)

Month	30-year average 1886–87 to 1915–16	Averages by 10-year periods		
		1886–87 to 1895–96	1896–97 to 1905–06	1906–07 to 1915–16
July	82.69	75.06	77.08	95.93
August	82.44	76.08	77.15	94.07
September	84.21	76.85	79.27	96.53
October	84.83	77.68	79.82	96.99
November	84.60	76.94	80.66	96.19
December	85.67	76.05	81.63	99.34
January	86.84	75.25	82.02	103.26
February	88.35	75.77	83.54	105.75
March	87.23	75.85	81.87	103.97
April	88.73	77.45	82.07	106.67
May	92.11	79.19	86.50	110.64
June	86.83	76.11	81.68	102.71
Spread between August and May prices	9.67	3.11	9.35	16.57

* Data from Federal Trade Commission, *Prices of Grain and Grain Futures* (Report . . . . on the Grain Trade, Vol. 6), 1924, pp. 66, 68.

period the price level of wheat was declining, while during the second period it was rising, which would explain in part the differences in seasonal variations. The high figure for the last ten-year period was attributed largely to the rapid rise of wheat prices during the last two years of the period.[1]

The Commission prepared a table of computed carrying costs (storage, interest, and insurance) for wheat at Chicago from 1886 to 1920.[2] These published carrying expenses were larger than the average increase in wheat price from August to May. For the first decade, when the seasonal change was only 3.11 cents per bushel for the nine months, the computed average carrying charge was around 14 cents. For the second ten-year period, when the seasonal change from August to May was 9.35 cents, the average carrying charge was around 12 cents. For the last ten-year period, when the average seasonal change from August to May was 16.57 cents (clearly abnormal because including two war years), the average carrying charge was around 14 cents. Only in a few years did the spread between August and May equal the computed carrying expense for that year, and these were mostly in the decade 1907–16. It followed that, except in the last period, the formal and published carrying charges exceeded the seasonal variation, for which an explanation had to be sought in other factors, some of which were considered by the Commission.

What the Federal Trade Commission called the "annual price cycle" was substantially what we have termed the recurring seasonal price variation, but the Commission's discussion made reference also to the crop-year price movement, as we have termed it. To quote another passage:

> The seasonal cycle of grain prices is determined chiefly by the course of market receipts, by the accumulation of visible supplies, and by the cost of carrying the grain through the winter from the time of large receipts to the period of comparative scarcity near the end of the crop year.[3] Decennial average seasonal curves show a rather marked regularity, but when individual years are studied this regularity frequently vanishes. Prices may show either a larger increase toward the close of the crop year than is justified, followed by a sharp readjustment at the close, or a decline through most of the year. So many different factors influence the price level at any time that it becomes difficult, if not impossible, to isolate one particular factor and determine its effect.[4]

The Commission also considered several factors that influence the crop-year price movement outside of the recurring seasonal price variation: the carryover, increasing and decreasing crops, transition from one crop year to another, increasing and decreasing wheat price levels, farm market-

[1] In the price series used by the Federal Trade Commission were included four squeezes on the Chicago market—during 1887–88, 1897–98, 1904–05, and 1908–09—which disturbed the seasonal variation from fall to spring. These Chicago squeezes in 1904–05 and 1908–09 had little influence on the weighted prices in Minneapolis, St. Louis, and Kansas City, used later in our tabular illustration of seasonal price variation.

[2] *Op. cit.*, Table 68, p. 195. The estimates were maximal rather than actual.

[3] Author's note: In the trade other factors are included, such as course of country marketing, mill demand, prices of other grains, rate of export, and behavior of futures.

[4] *Op. cit.*, p. 74.

ing, terminal receipts, and the visible supply in their relations to the annual cycle of wheat prices; it did not, however, establish clear-cut correlations of significance.

Now it is one thing to ascertain and assign the causes for all the variations in wheat prices that occur within a crop year; it is another to isolate the variations that may properly be regarded as due to seasonal influences proper (as distinguished from erratic and inter-seasonal influences); and it is still another to measure the characteristic or typical, or the average, recurring seasonal variation. The Commission's calculations represent a rough measure of the average seasonal variation; its discussions, however, pertained more largely to the causes of intra-seasonal and other fluctuations of various sorts.

Partly to supplement the studies made by the Federal Trade Commission and partly because we believe the wheat prices made available by the Department of Agriculture subsequent to the investigations of the Commission are superior to those used by the Commission, we have undertaken a tentative incursion into the subject.

Another Rough Analysis

In order to form an estimate of the occurrence and extent of the expected movement of cash wheat price from fall to spring, we employ the material in Table 8, derived from data in Appendix Tables II–V. Since it might be misleading to contrast the lowest price in the summer or autumn with the highest price in the spring (because these might be exceptional), and since the quotations ought hardly to be confined to months in which futures are closed out, it will serve to use the averages of two months.[1] In the case of the winter wheats, the average price of hard winter wheat during July–August in Kansas City is contrasted with the average of the subsequent May–June price on the same market; for soft red winter wheat, a corresponding comparison is made of prices on the St. Louis market. In the case of hard spring wheat, the September–October price at Minneapolis is contrasted with the subsequent May–June price. In the case of Winnipeg, the contrast would be between the averages of October–November and the subsequent May–June.

With the hard winter wheats, the period of waiting would be two months longer than with American hard spring wheat. This, however, is necessary since cash prices on spring wheat cannot be quoted until the new crop is in, and it is advisable, on account of the peculiarities of the July future, to have the spring quotations terminate with June. Other things being equal, therefore, one would expect a narrower price change with American spring wheat than with the winter wheats, because the term is shorter.

In the fourteen crop years before the war, the May–June price of hard winter wheat at Kansas City was higher than the July–August price in ten years, but in four years it was lower. In the case of soft red winter wheat at St. Louis, the same was true, but in two years the directions of deviation were different. In the case of hard spring wheat at Minneapolis, the May–June price was higher in nine years, lower in four, and unchanged in one. In only one year, 1910–11, was the spring price of wheat lower than the post-harvest price in all three markets. The outcome in the three markets, thus considered, exhibited some irregularity.

The following averages of the price changes in seven-year periods shown in Table 9 must be regarded with circumspection, especially because of the inclusion of several highly exceptional years. For example, in 1908–09, due largely to international circumstances, the spring price of wheat was extraordinarily elevated; this had a pronounced effect upon the averages, since in that period there was no corresponding occurrence of an extraordinary price decline from fall to spring. Taking the averages for what they may be worth, the mean change from July–August to May–June at Kansas City was 8.3 cents during 1900–07, and 8.9 during 1907–14. At St. Louis, the mean change was 10.7 cents per bushel during 1900–07, and 11.4 during 1907–14. The mean change from September–October to May–June at Minneapolis was 6.7 cents per bushel during 1900–07 and

[1] The averages of three post-harvest and three pre-harvest months would give about the same result.

5.3 cents during 1907–14. The occurrence of minus as well as plus deviations, the wide dispersion, and the general appearances of irregularity indicate that while a seasonal movement was in evidence, as suggested in the averages, other influences were frequently at work to exaggerate or minimize the strictly seasonal influence. At Winnipeg, the average change from October–November to May–June was 4.6 for the five-year period, 1909–14.

With respect to the seven post-war years, 1921–28, the changes conformed more closely to the doctrinal expectations, since there was only one minus year in the seven, and that only at Kansas City and St. Louis, not at Minneapolis or Winnipeg. On the other hand, in two years the increases in wheat prices from fall to spring were extraordinarily large, due to the shift from a lower to a higher price level in 1924–25 and to a crop scare in 1927–28. Taking the averages for what they may be worth, over the seven years 1921–28 the average change at Kansas City from July–August to May–June was 11.9 cents, at St. Louis, 18.9 cents. The change from September–October to May–June at Minneapolis was 12.7 cents; the change from October–November to May–June at Winnipeg was 15.6 cents. The increases in the post-war years have been more in conformity with the theory of the

TABLE 8.—NET CHANGE BETWEEN AVERAGE CASH SALES PRICES OF VARIOUS WHEATS AT BEGINNING AND END OF CROP YEAR, 1900–14 AND 1921–28*

(*Cents per bushel*)

Crop year July–June	No. 2 Hard Winter at Kansas City			No. 2 Red Winter at St. Louis			No. 1 Northern Spring at Minneapolis			No. 1 Manitoba Northern at Winnipeg		
	Average of July–August prices	Average of May–June prices	Net change	Average of July–August prices	Average of May–June prices	Net change	Average of Sept.–October prices	Average of May–June prices	Net change	Average of Oct.–November prices	Average of May–June prices	Net change
1900–01..	67.5	68.5	+ 1.0	74.0	72.0	— 2.0	76.0	71.0	— 5.0	....	....	.....
1901–02..	65.0	72.0	+ 7.0	68.5	79.5	+11.0	65.0	75.0	+10.0	....	....	.....
1902–03..	68.0	71.0	+ 3.0	68.5	77.0	+ 8.5	68.5	81.0	+12.5	....	....	.....
1903–04..	71.5	90.5	+19.0	80.5	107.5	+27.0	83.5	94.0	+10.5	....	....	.....
1904–05..	90.5	100.5	+10.0	99.0	106.5	+ 7.5	116.0	111.5	— 4.5	....	....	.....
1905–06..	82.0	79.0	— 3.0	87.0	91.0	+ 4.0	83.5	83.5	0.0	....	....	.....
1906–07..	69.5	90.5	+21.0	72.5	91.5	+19.0	75.0	98.5	+23.5	....	....	.....
1907–08..	86.5	98.5	+12.0	88.0	99.0	+11.0	110.0	108.5	— 1.5	....	....	.....
1908–09..	96.0	137.5	+41.5	93.5	148.0	+54.5	103.5	132.5	+29.0	....	....	.....
1909–10..	108.0	107.5	— 0.5	112.5	109.0	— 3.5	104.0	109.5	+ 5.5	97.0	95.5	— 1.5
1910–11..	102.0	89.0	—13.0	104.5	91.0	—13.5	108.5	98.0	—10.5	95.0	96.0	+ 1.0
1911–12..	90.0	110.0	+20.0	86.0	116.0	+30.0	109.5	114.5	+ 5.0	99.5	105.0	+ 5.5
1912–13..	90.5	87.5	— 3.0	103.5	101.5	— 2.0	89.5	91.5	+ 2.0	88.0	94.5	+ 6.5
1913–14..	82.5	87.5	+ 5.0	86.5	90.0	+ 3.5	85.5	93.0	+ 7.5	82.0	93.5	+11.5
1921–22..	116.5	125.5	+ 9.0	123.0	128.0	+ 5.0	142.5	155.0	+12.5	103.0	137.5	+34.5
1922–23..	108.5	110.0	+ 1.5	110.5	128.0	+17.5	112.5	122.5	+10.0	105.5	113.5	+ 8.0
1923–24..	98.5	107.0	+ 8.5	98.0	114.0	+16.0	120.5	123.5	+ 3.0	96.0	107.5	+11.5
1924–25..	119.5	161.5	+42.0	136.5	187.5	+51.0	138.0	165.5	+27.5	162.0	176.5	+14.5
1925–26..	159.0	154.0	— 5.0	165.5	154.5	—11.0	149.5	162.5	+13.0	134.5	153.5	+19.0
1926–27..	134.0	143.0	+ 9.0	138.0	146.0	+ 8.0	146.0	148.0	+ 2.0	142.0	158.0	+16.0
1927–28..	135.5	153.5	+18.0	141.5	187.5	+46.0	131.5	152.5	+21.0	144.5	150.0	+ 5.5

* Based on data in Appendix Tables II–V.

TABLE 9.—AVERAGE CHANGES BETWEEN CASH SALES PRICES OF VARIOUS WHEATS AT BEGINNING AND END OF CROP YEAR, BY PERIODS*

(*Cents per bushel*)

Period	No. 2 Hard Winter at Kansas City	No. 2 Red Winter at St. Louis	No. 1 Northern Spring at Minneapolis	No. 1 Manitoba Northern at Winnipeg
1900–07.....	8.3	10.7	6.7	....
1907–14.....	8.9	11.4	5.3	4.6[a]
1921–28.....	11.9	18.9	12.7	15.6

* Based on data in Table 8.

[a] Average of years 1909–10 to 1913–14.

carrying charges than was the case in the fourteen years before the war.

Even more significant is the observation that in the pre-war period of fourteen years there were only six years in each market in which the advance in price approached or exceeded what may reasonably be considered a low estimate of the inclusive carrying charges. In four years there was a decline or no net advance; in the other four, the net advance was appreciably below the cost of carrying wheat from soon after harvest until the late spring. In the post-war period of seven years there were only two in which the net advance in price clearly equaled or exceeded the full gross carrying charges.

Let us next consider the situation according to a formulation most favorable to the merchant carrying wheat. Let us assume that in each of the seven years in the three periods, the wheat was purchased in the cheapest month of the three months following the harvest (July, August, and September for winter wheat, and September, October, and November for spring wheat), and sold in the dearest month of the three months at the end of the crop year (April, May, and June). Using the figures in Appendix Tables II–IV, it is assumed that the merchant purchased a cross-section of the wheats of the grade in each market. For each year the price change is noted and the number of months involved. These are then combined and averages secured.

The resulting figures, summarized below in cents per bushel, represent, in monthly averages, the increased price in cents per bushel (representing the seasonal movement of the wheat price), that would have accrued to the wheat merchant in each period had he purchased a cross-section of wheat of the stated grade, during the lowest price month of the three months following the harvest and sold it in the highest price month of the three months prior to the next harvest:

	1900–07	1907–14	1921–28
Hard spring wheat	1.5	1.4	3.1
Hard winter wheat	1.3	1.4	2.2
Soft red winter wheat	1.5	2.0	3.1

This, of course, gives an exaggerated figure for the seasonal change, since no one buys at the bottom and sells at the top. Yet even with this exaggerated change, it is clear that the full published carrying charges would hardly have been covered in any period in any market before the war. The 3.1 cents per month given as spreads for the period 1921–28 for hard spring and soft red winter wheats, would have covered the carrying expenses remuneratively; but the others would have been barely sufficient or insufficient.[1]

Influences Obscuring Recurring Seasonal Movements

The recurring seasonal price advance does not begin at the same time or from the same relative position, year after year, even when the wheat price level remains the same. There is always more or less difficulty attending the transfer from the closing prices of the old crop to the early prices of the new crop. The old wheat has borne the carrying charge and its milling qualities are known; the new wheat has borne no carrying charge and the milling qualities are not yet established. With pressure of farm shipments and terminal receipts, new-crop prices tend to sag; the sagging is more or less deep and more or less prolonged in different years. The carryover, as well as the new crop, influences the course of prices

[1] An interesting side-light on the question is afforded by Liverpool wheat prices, as shown by Broomhall's series, assembled by the Department of Agriculture, for good average quality imported red wheat at Liverpool. Taking forty years before the war, 1875–1914, the May price was higher than the preceding November price in 19 years and lower in 20 years. (The price for November 1904 is not available.) The differences were usually not pronounced, but sometimes the spreads were very wide. Thus, in five of the years the May price was more than 15 cents higher than the November price and in three of the years the May price was more than 15 cents lower than the November price. Liverpool was of course in position to reflect the low post-harvest price of every exporting country. Over the period, a change occurred; in the first twenty years, the May price was higher than the November price seven times and lower thirteen times; but in the last twenty years, the May price was higher than the November price twelve times and lower seven times. A secular trend, downward in the first half, and upward in the second, was at least in part responsible for this turn of price developments. Whenever in any year during this period, American export wheat appeared on the market in Liverpool both in November and May, if the May price in Liverpool were lower than the November price, this tended to keep down the American May price, relative to the price in November.

directly after harvest. Ordinarily, during the late winter and early spring months, the July future is at a discount under the May future. The smaller the visible supply and the prospective carryover of old wheat, the more the July future tends to be under the May future; the larger the visible supply and the prospective carryover of old-crop wheat, the more the July future tends to a premium over the May future. Often, also, there is difficulty in transition from the July future to the September future. The hedges of millers and terminal elevators against cash purchases of country wheat are by many believed to intensify the sag of wheat prices directly after the harvest. Wheat growers are convinced that short selling by speculators has this effect. However deep or prolonged the post-harvest depression of prices (which in exceptional years may be absent), sooner or later the recurring price advance appears and, other things equal, continues over the winter.

In order equitably to appraise the price movement from fall to spring, it is necessary to study the price-influencing factors in each year. The early post-harvest price of winter wheat in the American market may be influenced by developments in the Southern Hemisphere; the spring price of wheat may be particularly influenced by developments in both the Southern and the Northern Hemispheres. If, in the summer, for illustration, the forecast for wheat in the Southern Hemisphere is reduced, the tendency to price decline in the American market would be restrained, or indeed, the price might rise; conversely, if a bumper crop in the Southern Hemisphere should be forecast, the wheat price would be depressed in the American market. Similarly, an early forecast of a small or large crop in Canada would influence wheat prices in the summer or autumn upward or downward in the United States. If influences appear in the spring indicating a larger crop and a lower price for the next crop year, the May–June price may recede and stand relatively or absolutely below the price of the previous autumn; or if influences are evident suggesting a short crop and a high price for the following crop year, the May–June price on the American market would soar in anticipation. If, as, and when the price of wheat directly after the harvest is depressed below what it would seem it ought to be on the basis of supply and demand, then the recurring seasonal rise starts from too low a level, and the recovery from the temporary marketing price depression would tend to add to the seasonal change.

The summer and fall prices of wheat may be raised or lowered by factors outside of the domestic situation during the same crop year; and in the spring the price may be modified by domestic and foreign influences appertaining to the following crop year. Put in another way, the otherwise seasonal price movement may be exaggerated or minimized by various intra-seasonal influences; and, perhaps more important still, the seasonal price movement may be exaggerated or minimized by inter-seasonal influences. The wheat price of a crop year is to some extent the expression of conditions in the previous crop year and in the forthcoming crop year, and not alone in the crop year under consideration; variations between these three sets of influences find diverging expression in changes which are superimposed upon the so-called seasonal price movement from fall to spring.

How Wheat is Commonly Carried by the Trade

It seems clear from the several tables that if wheat were dealt in as a cash commodity, the margin between the price after the harvest and at the close of the crop year would not usually be sufficient, judging from the past, to cover the gross costs of carrying wheat.[1] This inference is fully accepted in the trade. Banks hesitate or decline to loan on unhedged wheat and grain merchants practically never carry wheat unhedged. Yet the wheat is carried season after season. For this the explanation is to be sought, at least in part, in exchange trading whereby, through the practice of hedging, a part of the risk is taken from the grain merchant and distributed over a body of speculators.

[1] In the absence of futures trading, the price change from fall to spring would be much larger, as is illustrated in domestic wheat prices in many European countries.

NOTE

In the United States the carrying of grain was early developed and organized on the basis of trading in wheat futures on established grain exchanges. In effect, the function of carrying wheat was taken over in part by speculators, through whose operations the grain merchants and millers were placed in position to secure insurance against risks by hedging their commodity operations. The same development occurred in Canada when she became an important wheat-exporting country. The North American development of the grain trade was associated with bulk handling and the transportation facilities adapted to it.

In Russia,[1] India, Argentina, and Australia (and in our Pacific States), on the contrary, the carrying of grain in the domestic markets was not, before the war, based on exchange trading. These countries had, for the most part, bag handling instead of bulk handling, with corresponding equipment of elevators, warehouses, and transportation facilities. The growers rarely held the grain throughout the season; usually the millers and grain merchants purchased the grain and took their chances with price developments. Exporting merchants, to some extent, practiced hedging in Liverpool or Chicago; but for the most part, the grain trade and grain exporters in the countries mentioned were engaged in cash wheat speculation, and were not protected by hedging. This situation still exists in Russia and to a large extent in India; but Argentina has gone over to exchange trading, though not yet fully developed, and Australia will presumably follow. Also, Argentina and Australia are going slowly over to bulk handling of wheat.

Whether wheat can be bought for cash after the harvest, stored through the winter, and sold for cash in the spring at a net merchandising profit, is one question. Whether wheat can be bought for cash after the harvest, hedged by a sale of futures in a selected month in the spring, sold at chosen intervals and the hedge bought in, at a net profit, is a different question. The one involves a straight comparison between increase in cash price and inclusive carrying charges. The other involves the question of the relation to carrying charges that holds after the harvest between the price of cash wheat and the price of futures in the months in which a hedge will be placed. The pertinent question for the grain trader is: With the cash price of wheat as it stands after the harvest, what prices of wheat futures in the different trading months would need to be secured in order effectively to hedge the transaction and insure a profit to the merchant as handler of the commodity? In theory, the price of the appropriate future must be so far above the cash price of the wheat as to cover the unavoidable carrying charges from the date of purchase to the month in which the transaction is hedged. But this simple situation does not usually obtain, despite the fact that current cash quotations are generally based on the price of the futures.

To a determining extent, the grain merchant is not passive, he does not accept the spread between cash and futures which he finds at the beginning; to a large extent, in a sense, he himself makes the spread throughout the year. He has two sets of variables in his operations: the cash wheat and the wheat futures in his hedges. He buys cash wheat as of the grade or on sample. He is a judge of wheat value, premium milling qualities, dockage, cost of cleaning, and the exact situation of each parcel in relation to specifications of the grade. He understands the influence of volume of operations on expenses. At the time of purchase of the wheat, each transaction is hedged in what appears to be the most favorable month and the most advantageous market. The hedge may be placed in the nearest trading month or in a distant one.

Terminal elevators are classed as private and public, space being available for engagement in the latter. Apart from elevators owned by municipalities and railways at ports of export, however, the so-called public terminal elevators are usually run by elevator operators[2] or grain companies.

[1] M. J. Bonn, writing in a totally different connection, has given a terse description of the procedure by which, under the Czarist régime of Russia before the war, the harvest-time price of wheat was brought down to the export basis. "The export of grain from Russia before the war was not the result of a Russian surplus of grain; it was brought about because taxes were collected from the Russian peasants at the time of the harvest. The peasant did not merely sell the grain that he could spare; instead he sold the amounts needed to make his payments. He did not sell what he could spare, but he got along without what he had to sell. The simultaneous sales depressed the price of grain to the plane at which export became profitable." [Our translation.] (*Befreiungspolitik oder Beleihungspolitik?* S. Fischer Verlag, Berlin, 1928, p. 59.)

[2] Cf. B. F. Goldstein, *Marketing: A Farmer's Problem* (New York, Macmillan, 1928), pp. 217–81.

Such elevators, registered and run as public elevators, are a trading protection to the operators, who need to have public space to deposit contract grain for delivery against hedges in case of a squeeze, or to make delivery whenever the current future is not at a sufficient discount under the later future to make it profitable to transfer the hedges. There is now practically no such thing as a speculator or a grain buyer engaging space in a public warehouse run as an independent enterprise. In effect, the public elevators are run for their own transactions by the operators of the private elevators. This makes it all the more important for these operators to keep their elevator space filled. Not only do costs fall as volume rises, the elevator man must have wheat on hand for merchandising purposes. To get grain into store, the elevator operator is usually prepared to face a cut in the stated rate of storage. In fact, wheat is often bought and put into store when the premium of the future over the cash only covers interest and insurance. Purely as a storage proposition, there is no money in running terminal elevators;[1] purely as a margin proposition, the increase in wheat price following the harvest does not cover the storage charges. Placing wheat in store constitutes merchandising opportunities for the wheat trader.

Conducting himself as a merchant engaged in commodity operations, the grain dealer proceeds to dispose of his wheat to the maximum commodity advantage. Some parcels will be binned separately and sold on sample to millers as premium wheats. Other parcels will be blended to meet mill specifications. For the rest, the wheats will be so cleaned and mixed as to raise the weighted grade. Stores of both off-grade and high-grade will be accumulated. A small amount of wheat ranking well above No. 2 specifications, on mixing with a large amount of wheat ranking below No. 2 specifications, will on occasions suffice to bring the entire lot up to the grade of No. 2. For the better-class domestic milling trade, the objective may be to grade up; for a lower milling trade and for the export trade, the objective may be to grade down. In general, the aim of mixing is to make the contract grade. An elevator company handling several million bushels of wheat, may increase the weighted grade of the entire lot to the extent of several cents per bushel. This is entirely legitimate, was contemplated in the federal grade act, and lies implicit in any set of wheat standards.

The unmixed and various mixed wheats will finally be merchandised on the basis of specifications and quality. In selling his wheats, the merchant will take advantage of short-term fluctuations in the cash markets and in the premiums of cash and futures; each bulge will add a little to his price, and he will hold back his sales during the brief declines. In short, from the standpoint of the intrinsic quality of his purchased wheats and in connection with price fluctuations in the cash wheat market, the merchant will persistently and effectively work to force the weighted sales prices, relative to the futures in which he has hedged, higher than the weighted purchase prices, and at the same time keep the gross expense charge to the lowest possible level.

At the same time, the merchant will usually find himself able to improve his hedging position. The prices of futures in the different markets and in the different months are continuously fluctuating, and by no means synchronously. By appropriate purchase and sale of futures the selling hedge will be closed out in one month or market and reopened in another month or market, whenever the net result is in the direction of increasing the margin between the original cash price paid for the wheat and the contract price of the latest hedge. By transferring the hedges so as to take advantage of developments in the futures market, the grain merchant is not infrequently in position to improve the relations between cash and futures in his transaction by as much as 10 or 15 cents per bushel between the time when the cash wheat was purchased after the harvest and closed out in the following May. When a parcel of wheat is sold, the hedge is usually closed out immediately.

The net effect of these bilateral operations is to increase the margin between

[1] Cf. Federal Trade Commission, *Terminal Grain Marketing* (Report . . . . on the Grain Trade, Vol. 3), 1922, p. 147.

weighted purchase price and weighted sales price to such an extent as to equal or exceed the cost of operating his elevator, and thus make the business routinely remunerative. Thus construed, the success of the enterprise of terminal merchandising in grain (whether directed from country or city) is founded not on the scope of operations made statistically apparent by contrasting post-harvest cash prices of wheat with the cash prices in May and June, but is the result of varying changes in premium of cash wheat over futures combined with efficiency in management. The statistical spread is only one factor in the operation.

Put in another way, there is no such thing as making money systematically by buying wheat in the fall and selling the unchanged wheat unhedged in the spring; or by buying wheat and hedging it in the fall and selling the unchanged wheat and closing out the original hedge in the spring. But there is profit to the efficient grain dealer, on the average, in buying wheat and hedging it after the harvest and merchandising it and handling the hedging account through the remainder of the crop year in accordance with varying developments in the market. Quite routinely in certain markets, the grain dealer will buy wheat in the fall when the December future is not high enough above the cash to more than cover bare interest and insurance, in the expectation that the spread between December and May will widen and cash premiums develop, which together will work out an assured profit.

Without going into further details, the experiences of the grain trade in most terminal markets warrant the following exposition. No terminal elevator can be operated as a public warehouse, leasing storage space for grain at the published rates, the operator not engaging in trade in grain; except in unusual years, not enough space would be leased to the public to cover insurance on the buildings and interest on investment. No grain house can continue in business solely with the use of leased public storage space at the published rates; except in a very unusual year, not enough grain would be bought and so stored to make the business remunerative. A grain merchant cannot afford to pay cash for storage at the published rates; an elevator cannot lease much space for cash at the published rates.[1] Combined, the two operations can succeed; separated, success is impossible for either. In effect, the elevator man cuts the storage rate to himself as grain dealer; as grain dealer, he uses storage space of himself as elevator man when he would not engage space if he had to pay cash for it at published rates. On the basis of published rates, the elevator man loses money; but as grain merchant he makes money. The net result is profit in the business of the combined grain dealer–elevator man. When the business operations of these grain houses are accounted, it is found that practically never are storage charges corresponding to the published rates secured by the elevator; a low storage charge is secured, then money is made in merchandising operations. In a sense, the running of the elevator is a side line, a necessary evil, to be run at little or no profit, in order to protect the grain dealer and widen his opportunities for merchandising wheat. The profits lie in merchandising; storage of wheat is an incident, and the rates of storage are bookkeeping entries. It seems established that if grain elevators are to be made available as public utilities, offering storage space on lease but unconnected with grain houses, these must be provided by states or municipalities; they cannot be maintained remuneratively as commercial enterprises.[2] The problem, if it be one, is unsolved in our terminal markets.

[1] In other terminal markets than Chicago, especially in Duluth and Minneapolis, there is considerable leasing of public storage space by grain merchants, and this is necessarily the case at seaports. Millers quite generally lease storage space, though this varies widely from year to year.

[2] "A possible remedy for the existing situation is to make it practicable for grain dealers not operating elevators to store grain in public elevators in competition with the big elevator merchandisers. To accomplish this would apparently require a reduction in storage charges. But the indications are that even at present storage rates a purely storage and transfer elevator cannot be profitably operated at interior terminal points. This difficulty might be met in either of two ways. The railroads might be required to operate elevators for the convenience of their shippers; or the government, presumably the State government, might operate storage elevators at rates sufficiently low to permit dealers without elevators to compete with the elevator merchandisers." Federal Trade Commission, *Terminal Grain Marketing* (Report . . . . on the Grain Trade, Vol. 3), 1922, p. xv.

Summary

In consequence of the cost of carrying wheat (disregarding the price difficulties in transition from one crop year to the next) the price of wheat tends to rise through the crop year. In most years the price rises from August to May, not as a straight line but rather as an irregular curve.

Other factors influencing wheat prices disturb this recurring seasonal price variation, which may be exaggerated, minimized, or obliterated entirely. Thus, under exceptional circumstances, the May price will rise above the August price by several times the carrying charges, or the May price may be lower than the August price. The course of prices from the beginning to the end of the crop year, the crop-year price movement, is a composite of the recurring seasonal price variation, conjoined with the elevating or depressing price effect of a number of possible price factors. These intercurrent factors are intermittent rather than continuous, but enter so often and so effectively into the field of price influence that the crop-year price movement is more often exceptional than conforming to expectations based on the recurring seasonal price variation.

If one will regard the price variations as revealed month after month from August to May at Minneapolis, St. Louis, and Kansas City, supplement these with corresponding figures for spot wheat and futures at Chicago, and with such prices in Winnipeg as are available, and evaluate them in the light of the wheat price levels of the crop years, the reasonable interpretation of the course of wheat prices through a crop year would run somewhat as follows. When there is no change in the wheat price level of the crop year and other things are equal, the price spread between August and May (October to May for spring wheat) ought in many years to equal the minimal cost of carrying wheat in terminals over eight or nine months. This set of assumptions, however, constitutes the exception rather than the rule, because other things are not equal and the wheat price level remains unchanged only occasionally. Commonly, the spread from August to May varies from year to year, a few cents above or a few cents below the bare carrying charge, more often below. If one uses the effective carrying charge—not the formal published carrying charge but the actual carrying charge that elevators are able to get along with—the crop years in which the spread between August and May equals the carrying charge would represent a larger proportion than is now the case.

According to averages, the spread in price of wheat from August to May since the war has been relatively higher than before the war. But the average is misleading on account of the occurrence of two years of exceptionally high wheat prices in the spring.

Without going at this time into the relations of cash and future prices, it is clear that as a routine procedure grain merchants cannot rely on the recurring seasonal price variation to cover the carrying expenses. It is the mixing of wheats, the merchandising of wheats on the basis of quality, and the spreading of hedges that make it possible for grain merchants to purchase wheats in the fall and dispose of them remuneratively throughout the remainder of the crop year.

VI. INTER-SEASONAL PRICE VARIATIONS

An important class of variations in wheat prices comprises the shifts in the wheat price level from one crop year to another. These we venture to term inter-seasonal variations. Like the recurring seasonal variations, they are commonly obscured by fluctuations within a crop year, and are not readily disentangled from the complex fluctuations revealed by price data. They tend to be especially pronounced in countries, like Canada and the United States, which are heavy producers and exporters of wheat, and less pronounced in countries, such as Great Britain, which import large quantities of wheat from several exporting countries which have different harvest periods. Occasionally, radical shifts in the price level occur within the crop year, as a

result of extreme developments in an important exporting country with a different harvest period—such as happened in 1925–26 in consequence of unexpected crop damage in Argentina.

Concept of Wheat Price Level

The concept of a wheat price level, like that of the general level of prices, is not difficult to grasp, though it is not easy to define or express in concrete terms. As we have already emphasized, wheat is not a unity, but a collection of types, varieties, grades, and qualities, in proportions that vary from year to year and in shorter periods, and with quite different values. Accordingly the price of wheat is not a point but a range, and a range which varies in width from time to time in any market or region and in height as well as width from region to region. With full recognition of this fact one may, in order to avoid the clumsiness of using a range, secure for any market or region a weighted average of the prices of all wheats within the range, or of the more significant wheats, or of certain wheats of major significance; and use such an average, with due reservations, as an index or condensed expression of the wheat price level.

Over periods of weeks, months, and years, the range itself, or an index derived therefrom, will rarely move horizontally; rather it will display movements up and down, some of brief duration, others well sustained. These movements represent fluctuations and shifts in the wheat price level, which are to be distinguished from variations in the relative prices of particular wheats whose prices enter into that level. However difficult it may be to define precisely what we mean by the price level, or to state just what it is in cents per bushel, we have no difficulty in apprehending that *wheat* is high or low, as compared with some other period or with some notion of what is usual or "normal," or that it is rising or falling, or that soft winter wheat is "out of line."

It is difficult in advance, or at the onset, to diagnose, so to speak, a shift in the price level, as distinguished from a temporary variation; but this is usually easy in a subsequent review of the crop year. It is in their ability to foresee shifts in the price level that some professional speculators show their greatest superiority over amateurs. The range of wheat prices may rise or fall as a block, or the price of one type may change more than that of the others. The general run of cash prices may rise while premiums decline or premiums may rise while the general run of cash prices decline, or premiums may go upward or downward with the general run of cash prices, though not proportionally.

From the concept of a wheat price level at a particular moment of time it is but a short step to the concept of a wheat price level over a period—a day, a week, a month, a quarter, or a crop year. The crop year is the most significant period, for the wheat crop of any one region is harvested within a few weeks and is not subject to addition from domestic sources until the ensuing harvest. Because of considerable variations in the size, composition, and character of crops from one year to another, and because demand is comparatively inelastic, substantial shifts in the price level from one crop year to another occur frequently.

These shifts are not identical in different markets or different regions. Indeed, striking regional divergencies occur; in many countries wheat prices were on a lower level in 1925–26 than in 1924–25, whereas in the United States, in consequence of a short crop of winter wheat and high tariff protection, the level was higher in 1925–26 than in 1924–25. No one market, at least in a single exporting country, dominates all other markets.[1]

The demarcation between two successive crop years is at best somewhat arbitrary. Even in the United States the harvest periods for winter wheat and spring wheat are several weeks apart. Since winter wheat predominates, the crop year commonly used runs from July to June; but the spring-wheat crop, for which the appropriate crop year is September–August, is sufficiently important to prevent July 1 from being a wholly satisfactory dividing line. Moreover,

[1] Cf. G. F. Warren and F. A. Pearson, *Interrelationships of Supply and Price* (Cornell University Agricultural Experiment Station Bulletin 466), March 1928, p. 64.

other countries with quite different crop years (Canada, October–September; Argentina, January–December; Australia, December–November) are large competitors in international wheat markets from which influences arise and react upon United States markets. Furthermore, it is not only the actual harvest that influences the price level when the wheat is ready for market. Crop prospects exert considerable influence for several months before harvest, and the carryover from the old crop affects prices in the early part of a year or throughout it. The inter-seasonal shifts are seldom extremely abrupt, but in some years they are more gradual than in others. Apparently June, July, and August are the commonest months of transition.

The "hangover" influence of the last crop year is likely to be limited to the first months of the current crop year, and will ordinarily influence the weighted price to no pronounced extent. The price influence of the coming crop year may appear quite early in the current crop year, in the event that fall-sown wheat in the Northern Hemisphere goes into the winter under unfavorable circumstances. Later, the degree of winterkilling of the winter wheat of the coming crop year and the conditions of seeding of the spring wheat of the coming crop year may have a pronounced influence on the price of wheat during the current year, through an interval extending from March to July. It is possible to find crop years of which one may say that the wheat price level of the crop year was determined largely by relations of supply and demand within the year, without substantial modification by influences from the previous or the succeeding crop year. On the other hand, it is possible to find crop years in which the price level of the crop year was substantially modified from what it would otherwise have been by influences dating from the crop year preceding it or developments of the crop year succeeding it. It is certainly the rule, rather than the exception, to have the wheat price level of a crop year determined in part by influences outside of the year and not alone by relations of supply and demand within the crop year.

In some years prices remain close to an average figure throughout the season and the concept of a price level characteristic of the season is clearly applicable. The average appears to represent accurately the price level of the season. But in other years prices remain close to a given level through a considerable portion of the season, and then depart widely from this level for part of the season—perhaps at the beginning of the season, more often at the end, sometimes for a month or two at some time during the season. One naturally thinks of the level maintained during most of the season as the representative level of the season and regards the exceptional period as unrepresentative. An average including the period of extreme prices may appear to fail properly to represent the price level most significantly characterizing the season. In still other years, price fluctuations are so great or the levels during different months so diverse that an attempt to conceive of any one price level as characteristic of the season puts a severe strain on the imagination. In such case, although an average may be computed with any desired mathematical accuracy, it can hardly be regarded as representative in any but a purely formal sense.

Though in most years some one price level appears, in retrospect, adequately representative of the price through the season or through most of the season, it is not easy to discern, while it is being developed from day to day, the price level that will later be shown to be characteristic of the crop year, or even whether any one level will appear truly representative. In an occasional crop year with clear relation of supply to demand and easy adjustment of exporters' surpluses to importers' requirements, there may suddenly appear in the winter or spring a war rumor or a scare of widespread crop failure. Such possibilities being imponderable, everyone in every country tries to play safe and the world price of wheat rises as the expression of prevision and insurance against disaster. Later the possibility of war is dissipated, or the crop failure is averted and a harvest secured approximating the amount anticipated before the scare of crop failure arose; the price declines to where it would presumably have been had the untoward development not occurred. But the weighted price of the

year is substantially higher than it otherwise would have been. One must not play loosely with the word "characteristic"; but clearly some wheat price levels are more characteristic than others in their relations to the demonstrable and verified factors of supply and demand.

Other factors also enter. Even though the wheat price level of two successive crop years may later turn out to be the same, price movements will occur, or may occur, between May and September, particularly in the futures market, but also in cash wheat. These represent the adjustments in the trade, adjustments of mills to different qualities in the two crops, and also differences of opinion as to the incoming crop. In some years they are due to squeezes in the closing of the month of exchange trading. Apparently it is not to be expected, even with crops identical in quantity and quality and with no change in the international situation, that the transition from the close of the one crop year to the harvest of the following crop year can be traversed with that minimum of price fluctuation observed prior to and subsequent to the period of transition. It is common to find considerable fluctuation of price with the transfer of futures from May to July and from July to September. Futures trading is designed to smooth out the difficulties in the transition from one crop year to another; but sometimes it seems to exaggerate or prolong them.

Series Showing Inter-Seasonal Variations

From what has been said it follows that the wheat price level is almost continually in movement, and that the inter-seasonal variations are only one type, though often the major one, of the changes in level. A really trustworthy view of the actual movement can be obtained only from monthly data, or from smooth curves run through daily or weekly prices. Crop-year averages of daily or monthly prices give an exaggerated impression of the sharpness of price transitions from one crop year to another. Nevertheless, such averages are helpful in focusing attention upon the inter-seasonal variations.

As convenient indications of the price level one may select from a large number of series. We have chosen several series which are given in Table 10, in terms of annual averages for July–June years, for the three seven-year periods previously used. Five of these series are the same as those used in earlier tables—weighted average prices of No. 1 Northern Spring at Minneapolis, No. 2 Red Winter at St. Louis, and No. 2 Hard Winter at Kansas City; and unweighted monthly averages of daily closing prices of No. 1 Manitoba Northern at Winnipeg and of good average quality imported red at Liverpool. Further we have used average monthly prices of wheat exported from the United States to Europe and of wheat imported into the United Kingdom.

The figures given in Table 10 are not the annual averages of monthly items given in Appendix Tables II–VII, but these averages after certain adjustments. The bare figures, as derived, are not properly comparable because of changes in the value of the dollar over the period. This bias may be roughly eliminated by dividing the average wheat prices in each year by the all-commodity wholesale price index number (on a 1913 base) for that year. For adjustments of all the series shown, we have employed the all-commodity wholesale price index number of the U.S. Bureau of Labor Statistics computed for fiscal years. The British series had already been converted into United States currency equivalents, and the Canadian series is expressed in what is almost equivalent to United States currency. This enables us to review, on a roughly comparable monetary basis, the seven series of prices over three seven-year periods.

It is not to be assumed that the averages for the year given in these tables closely represent the wheat price levels of the years as they might be secured from more comprehensive data. This is true especially for the prices of particular grades; although these are the most representative grades from the milling standpoint, the wheats of these grades are not represented in the crops in the same proportions year after year. In the case of the American wheats, the post-war averages are not as trustworthy as the pre-war averages on account of differences in premiums for protein. Reservations concerning the other series

TABLE 10.—ANNUAL AVERAGE PRICES OF WHEAT, 1900–01 TO 1913–14 AND 1921–22 TO 1927–28, ADJUSTED BY WHOLESALE INDEX NUMBERS ON 1913 BASE*

(*Cents per bushel*)

Crop year July–June	No. 1 Northern Spring—Minneapolis		No. 2 Red Winter—St. Louis		No. 2 Hard Winter—Kansas City		Exports from U.S. to Europe	No. 1 Manitoba Northern—Winnipeg	Average red, spot—Liverpool	Imports into United Kingdom	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(B)	(A)	(B)
1900–01	94	94	94	93	86	86	93	...	110	114	113
1901–02	87	87	90	96	84	87	90	...	107	106	106
1902–03	87	87	82	83	79	79	88	...	103	101	101
1903–04	105	105	101	112	91	94	95	...	106	105	105
1904–05	128	128	121	129	113	118	103	...	110	108	108
1905–06	99	99	104	105	92	92	94	...	113	108	109
1906–07	90	90	83	86	79	80	87	...	102	100	99
Average	99	99	96	101	89	91	93	...	107	106	106
1907–08	116	116	105	107	102	104	110	...	120	118	119
1908–09	124	123	112	126	107	119	110	...	129	124	124
1909–10	107	110	111	117	105	106	101	102	118	116	116
1910–11	110	110	104	102	103	98	98	101	112	109	109
1911–12	112	112	98	105	101	106	98	103	117	112	113
1912–13	87	90	105	106	88	87	98	92	114	110	110
1913–14	89	90	90	93	85	86	97	90	107	106	106
Average	106	107	104	108	99	101	102	98	117	114	114
1921–22	100	103	89	91	84	85	96	91	106	109	108
1922–23	77	79	78	82	73	72	81	72	92	90	90
1923–24	78	79	71	74	70	71	75	67	84	81	81
1924–25	101	102	103	111	87	97	104	107	117	111	113
1925–26	103	104	109	110	105	104	102	97	113	109	110
1926–27	99	100	94	93	92	93	100	99	116	112	112
1927–28	92	95	101	108	92	94	96	101	108	106	106
Average	93	95	92	96	86	88	93	91	105	103	103

* Based upon annual averages given in Appendix Tables II–VII, except for United States export prices, which are from *Commerce and Navigation of the United States* and *Monthly Summary of Foreign Commerce*. The averages for the three seven-year periods are simple arithmetic averages of the annual prices. The columns headed (A) represent adjusted weighted average annual prices; the columns headed (B) represent adjusted unweighted annual averages of monthly weighted average prices. Adjusted prices computed by Food Research Institute with the use of July–June averages of the monthly all-commodity wholesale price index numbers of the U.S. Bureau of Labor Statistics, 1913 base, which run as follows:

1900–01	78.9	1907–08	91.5	1921–22	142.3
1901–02	81.4	1908–09	92.9	1922–23	155.7
1902–03	86.6	1909–10	101.5	1923–24	150.3
1903–04	84.8	1910–11	95.2	1924–25	154.8
1904–05	86.1	1911–12	95.8	1925–26	155.7
1905–06	86.8	1912–13	100.1	1926–27	147.2
1906–07	91.2	1913–14	99.0	1927–28	147.4

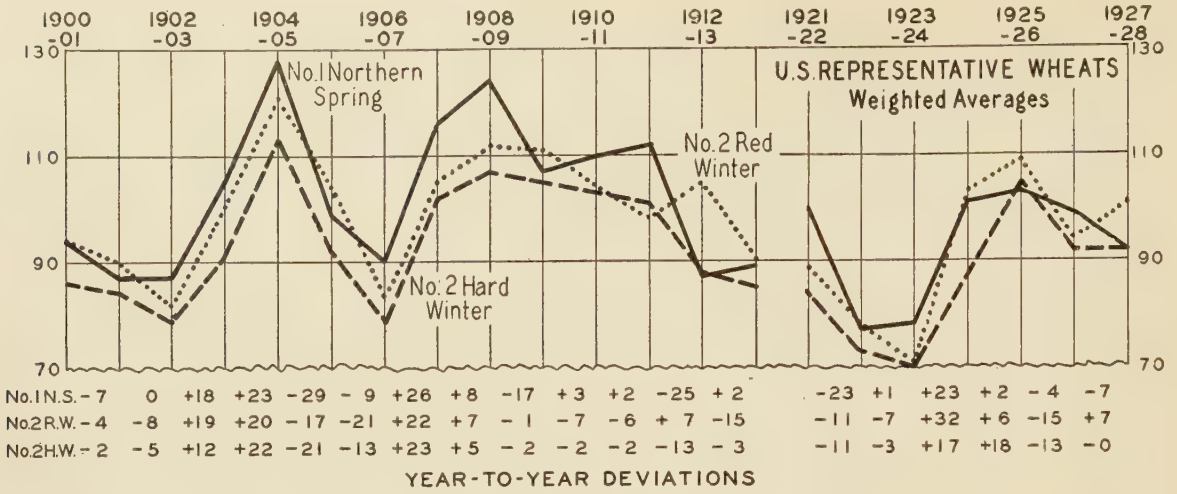
could properly be made. Nevertheless, with full consideration of all qualifying circumstances and of the fact that the price of wheat is really a range, the averages given may be taken as broad indication of the relative position of the wheat price level in different years.

COMMENTS ON THE SERIES

The adjusted prices are shown graphically in Chart 5 (p. 280). Annual averages of the monthly items of the three series of representative American wheats are shown in the first section in terms of weighted averages, and in the second section in terms of unweighted averages. The unweighted averages are usually higher, but in most cases not much higher. Weighting makes the most difference in the case of No. 2 Red Winter, and the position and conformation of its curve are quite different in the two sections. In the third section the other series are shown in terms of adjusted prices. The year-to-year deviations are

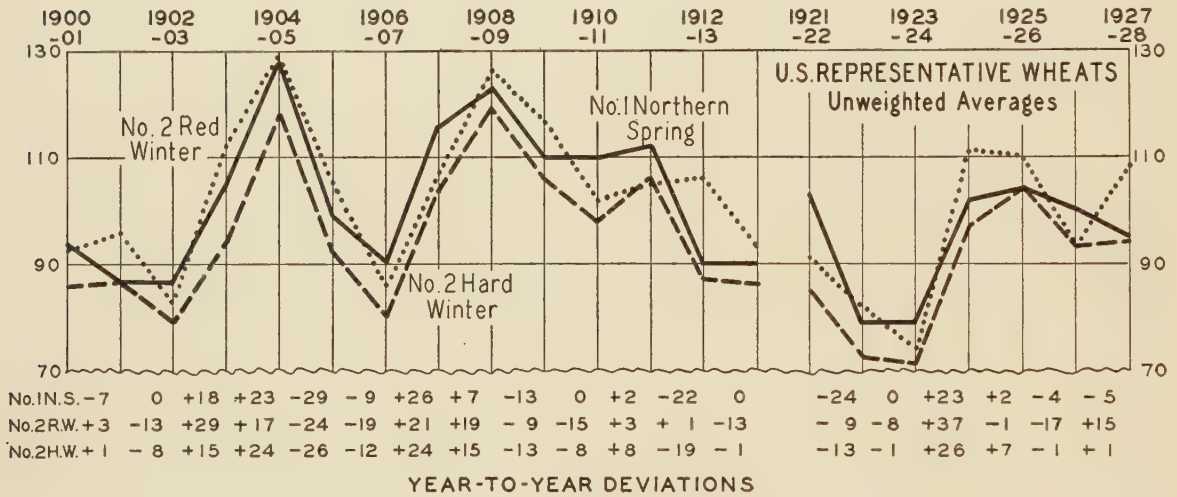
CHART 5.—ANNUAL AVERAGE PRICES, ADJUSTED BY WHOLESALE PRICE INDEX NUMBERS ON 1913 BASE*

(Cents per bushel)



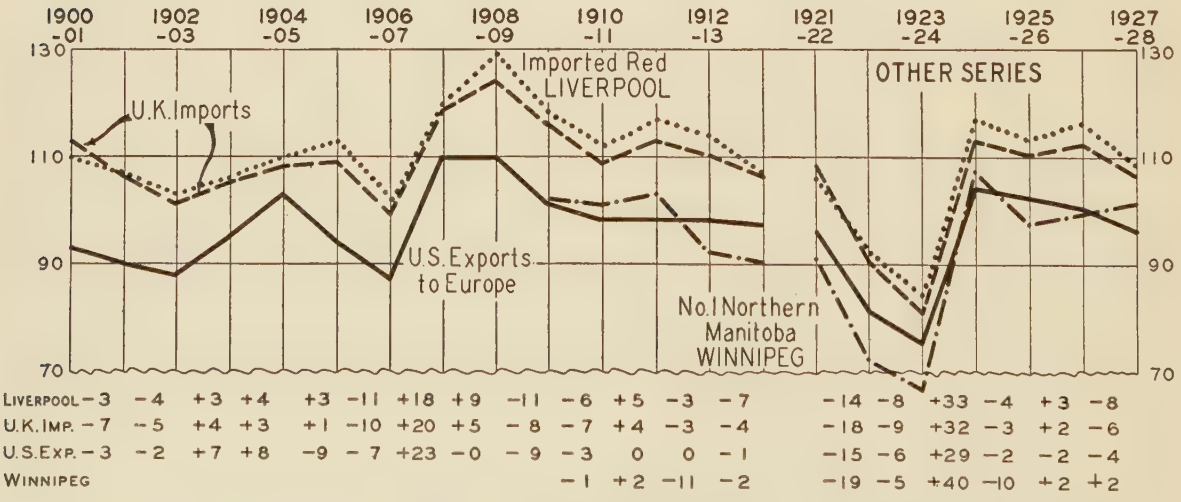
No.1 N.S. – 7	0	+18	+23	−29	− 9	+26	+8	−17	+3	+2	−25	+2		−23	+1	+23	+2	− 4	−7
No.2 R.W. – 4	−8	+19	+20	− 17	−21	+22	+7	− 1	−7	−6	+ 7	−15		−11	−7	+32	+6	−15	+7
No.2 H.W. – 2	−5	+12	+22	−21	−13	+23	+5	− 2	−2	−2	−13	− 3		−11	−3	+17	+18	−13	−0

YEAR-TO-YEAR DEVIATIONS



No.1 N.S. – 7	0	+18	+23	−29	− 9	+26	+7	−13	0	+2	−22	0		−24	0	+23	+2	− 4	− 5
No.2 R.W. + 3	−13	+29	+ 17	−24	−19	+21	+19	− 9	−15	+3	+ 1	−13		− 9	−8	+37	−1	−17	+15
No.2 H.W. + 1	− 8	+15	+24	−26	−12	+24	+15	−13	− 8	+8	−19	− 1		−13	−1	+26	+7	− 1	+ 1

YEAR-TO-YEAR DEVIATIONS



LIVERPOOL – 3	−4	+3	+4	+3	−11	+18	+9	−11	−6	+5	−3	−7		−14	−8	+33	−4	+3	−8
U.K. IMP. – 7	−5	+4	+3	+1	−10	+20	+5	− 8	−7	+4	−3	−4		−18	−9	+32	−3	+2	−6
U.S. EXP. – 3	−2	+7	+8	−9	− 7	+23	−0	− 9	−3	0	0	− 1		−15	−6	+29	−2	−2	−4
WINNIPEG									−1	+2	−11	−2		−19	−5	+40	−10	+2	+2

YEAR-TO-YEAR DEVIATIONS

* Data in Table 10 and Appendix Table XIV. For United States exports to Europe, weighted averages; and for Liverpool, United Kingdom imports, and Winnipeg, unweighted averages of monthly items.

shown in figures in each section of the chart.

In certain respects the curves are broadly in accord. The highest sustained level of prices was reached in the years 1907–08 to 1911–12; the lowest level of prices in 1923–24, with 1922–23 a close second. If years of conspicuously high and conspicuously low prices are ignored, the price levels in the three periods are not far apart; but because of the different distribution of years of high and low prices, seven-year averages show the second period distinctly the highest in level, and the post-war period slightly lower than the period 1900–07.

In detail, as one might expect, the consonance of the series as reflectors of the wheat price level is far from perfect, in respect to degree of change and, in some cases, to direction of movement as well. The outstanding case of disagreement in degree of change occurred in the first seven-year period. From 1902–03 to 1904–05 prices of representative wheats in the United States rose sharply, following two short crops in the United States, to the highest level in the 21 years, and declined sharply in the two following years; whereas the series of United States export prices shows a much more moderate movement in this period, and the two British series a movement still more moderate. The British series reached no peak in 1904–05, and did not decline in 1905–06 as all of the American series did. In the three or four years just before the war, the downward trend of prices was considerable and erratic in the three American series and the Winnipeg series, but very moderate in the two British series, and almost imperceptible in the prices of United States wheat exported to Europe. In the post-war period, again, considerable divergence among the series is apparent, except for the general agreement upon 1923–24 as the year of lowest prices and upon 1924–25 as showing the greatest advance.

The two British series move rather closely together. In all but two instances (1900–01 and 1921–22) the unweighted average price of imported red wheat is higher, but never by more than a few cents a bushel. The comparison is but little altered if one uses a weighted average of monthly import prices instead of an unweighted average. The differences are probably due mainly to the fact that imported wheats which do not enter into the series of red wheat prices average lower in price either in general or in particular months of heavy imports of these wheats.

Among the three series of United States representative wheats, No. 2 Hard Winter is almost invariably the lowest, but No. 2 Red Winter and No. 1 Northern Spring change their relative positions frequently. Conspicuous cases of divergence in direction or extent of deviations, or both, are readily observed. On the whole, judged by the unweighted averages for the periods, No. 2 Red Winter shows the greatest inter-seasonal variation in price. Medians of the deviations show No. 1 Northern Spring as the least variable, and it has the greatest number of small inter-seasonal variations; but these are due largely to the fact that its inter-seasonal variations tend frequently to be reduced by the overlapping of its true crop year (September–August) with that of winter wheat (July–June).

In one year, 1922–23, the deviation for No. 1 Northern differed by 11 cents from that of No. 2 Hard (using unweighted average prices). In three years, 1902–03, 1908–09, and 1910–11, the difference was 8 cents. In 1926–27 it was 7 cents, in 1901–02 and 1911–12, 6 cents, in 1925–26, 5 cents. In one year, 1912–13, the deviation for No. 2 Red differed from that for No. 2 Hard by 18 cents; in two years, 1903–04 and 1927–28, the difference was 14 cents; in 1913–14 it was 12 cents and in 1924–25 it was 11 cents; and in six additional years it was over 5 cents. The divergencies appear to arise largely from differences in relative size of the crops of the three classes of wheat, from changes in the average quality of the crops from year to year, and from differences in the abundance of wheats showing the peculiar milling and baking characteristics represented respectively by these three classes. Other factors also must play a part in creating these differences.

Price differences arising from peculiar qualities of the wheats are much more pronounced in the American markets where the wheat is largely bought on sample and selected for particular characteristics and

where there is a representative offering of the various qualities within the grade, than in the British market where the American wheat is largely bought on grade and where the wheat received is the remnant of the crop after the most desirable portions have been picked out by American millers. The British market, furthermore, drawing wheat from all the principal producing sections of the world, less frequently suffers from shortage of supplies of particular qualities than markets which draw on a limited territory.

The range of variations shown by the adjusted figures (1913 base) in Table 10 and in Appendix Table XIV are summarized below, using unweighted annual averages for the three representative United States wheats and British import prices, in cents per bushel:

	No. 1 Northern Spring	No. 2 Red Winter	No. 2 Hard Winter	U.S. export prices	Liverpool imported red	U.K. import prices
High	128	129	119	110	129	124
Median ...	100	105	93	97	110	109
Low	79	74	71	75	84	81
Range	49	55	48	35	45	43
Extreme one-year deviation	29	37	26	29	33	32
Extreme two-year deviation	41	46	39	27	29	29

The ranges are around 50 per cent of the median prices, in the case of representative United States wheats, but considerably less in the export and import series. In exceptional years the inter-seasonal variation may cover one-half to three-fourths of this range, and between one year and the second year following, it may run higher still.

All but one of the series show the largest inter-seasonal variation between 1923–24 and 1924–25: No. 1 Manitoba Northern rose 40 cents, No. 2 Red Winter 37 cents (unweighted average), imported red at Liverpool 33 cents, British import prices (unweighted average) 32 cents, United States export prices 29 cents, and No. 2 Hard Winter (unweighted average) 26 cents. The 23-cent change in No. 1 Northern Spring (unweighted average) in 1924–25, however, was equaled in 1904–05 and exceeded in 1905–06 (−29 cents), 1907–08 (+26 cents), and 1922–23 (−24 cents), and was almost equaled in 1912–13 (−22 cents). The maximum two-year rise occurred in 1902–03 to 1904–05 for No. 1 Northern Spring and No. 2 Red Winter, and in these years and 1906–07 to 1908–09 for No. 2 Hard Winter, and between 1923–24 and 1925–26 in the other series, except No. 1 Manitoba Northern, for which it occurred between 1922–23 and 1924–25. In the case of the three representative United States wheats, the maximum two-year variation downward before the war, from 1904–05 to 1906–07, was greater than any two-year deviation, positive or negative, in the last period. The maximum two-year deviation regardless of signs occurred between 1902–03 and 1904–05 in No. 1 Northern Spring and No. 2 Red Winter. Averages by seven-year periods show the maximum inter-seasonal variation in the first period in United States representative wheats, in the third period in the other series; it is rather noteworthy that in spite of the pronounced shift in price level between 1923–24 and 1924–25, the post-war period as a whole, subsequent to the general price decline in 1920–21, fails to show the maximum year-to-year variability, as judged by averages of domestic prices.

It will be observed that the different series do not entirely agree in respect to the direction of the price change from year to year. In the years 1910–11 to 1913–14, 1923–24, 1925–26, and 1927–28 the four American weighted price series show some variation in signs of deviations. The most extreme case of divergence was in 1912–13, when No. 2 Red Winter showed a rise of 7 cents while No. 1 Northern showed a decline of 25 cents and No. 2 Hard a decline of 13 cents. In extent of change, even where the signs of the deviations are the same, there is much less consistency, and there are striking differences in several cases. These differences are more numerous if one includes in the survey the two British series. In view of these inconsistencies, one clearly cannot rely upon any one series to express the course of wheat price level, and one must generally rest content with fairly broad statements concerning it.

Causes of Inter-seasonal Variations

The inter-seasonal price variations, or shifts in the wheat price level from one crop year to another, are due partly to domestic influences, but in large part are related to corresponding movements in the world price of wheat. Domestic circumstances determine whether the price of a particular variety follows the world price more or less closely; but the direction of movement is usually consistent. Throughout the period under review, American production of wheat has been one of the factors in the upward or downward movement of world price; at the same time, changes in the world price level resulting from conditions in Europe or in the other surplus-producing countries have been reflected back to the American price. Whether the American price lags behind the world price, or anticipates it, and the extent to which the American price and the world price are respectively modified, vary from season to season. Many Europeans tend to exaggerate the American influence on the world price, and many Americans tend to exaggerate the world influence on American price. Since the war, the tariff has modified the influence of world price on domestic wheat price.

The major factors causing upward or downward shifts in the American wheat price level from one crop year to another are numerous and interrelated. Now one, now another, is predominant or conspicuous. In discussions of price movements one or another is frequently overdrawn or underestimated. World crops and prices of wheat and other grains, domestic crops of wheat and other grains, domestic and world carryover and visible supplies of wheat and other grains, domestic exports, the exports of other surplus countries, importers' requirements—these all influence the American price to varying degrees in different years. A rise in domestic price level that is out of line with the contemporaneous Liverpool price will be checked, unless otherwise checked, when the point is reached where Canadian wheats enter duty paid; a decline in the domestic price level will be checked, unless otherwise checked, when domestic prices reach the export basis.

On the whole, the largest and most general deviations occur in years of a short crop, either in the United States (as in 1904–05) or in the world as a whole (as in 1907–08 and 1924–25). Also large are the shifts in years of large crops following short crops, as in 1905–06. Each of the periods yields illustrations of large inter-seasonal variations, for which the principal cause can be found in some outstanding change in the relations of supply and demand—chiefly changes in supply—at home or in the world at large. But one must not overemphasize the extent of variations. On the whole practically half of the year-to-year deviations are less than 10 cents (1913 values) a bushel, and the variations of 15 cents or more are confined to a few outstanding years, save for occasional exceptions shown by No. 1 Northern Spring and No. 2 Red Winter. What is sorely needed, though it may not be feasible, is accurate study of the correlation of American price movements with foreign price factors, following which a more exact explanation of the ever-present but varying lack of concordance would be possible.

The price of wheat in any year is also subject to influence by the prices of the other cereals, in themselves independently variable, as expression of changing relations in the equation of supply to demand of the other cereals. Lastly, the price of wheat in any year may be modified by the prices of other foodstuffs than cereals—for example, potatoes and meats. The current practices of merchandising wheat may modify somewhat the registration in price of the equation between supply and demand; but in the final analysis the supply and demand are equated in price.

The influence of speculation on price, whatever it may be on short-term and month-to-month variations, can hardly be regarded as of large importance in determination of shifts in price level from crop year to crop year. To say that prices, within a range, may be modified in a week, or a month, or over several months, by speculation, is one thing; but to say that by speculation the range of wheat prices may be elevated or depressed over a crop year, and from one crop year to another, other things being equal, is a very different matter. In

the determination of crop-year price levels, more ponderable factors than speculation are involved. At the same time, speculation and trading on established grain exchanges are of unquestioned importance in the prompt, simultaneous, and widespread registration of wheat prices on the markets of the world.

The factors determining shifts in the wheat price level of the crop year are the same as those determining variations in price within the crop year. But the weight of influence is naturally on the side of broad rather than of ephemeral factors, and considerations of physical volume predominate. Crop reports mean more and trade opinion less. Most of the incidental and accidental factors, and the short-term intercurrent influences, are discounted in the inter-seasonal price shift. The international influence is particularly marked, since the ranges of wheat prices are related in all countries engaged in international trade in wheat. World crops and world requirements are important; exporters' surpluses and import "requirements" still more important. Important also are supplies of substitutes. Thus broadly considered, shifts in wheat price level from crop year to crop year (adjusted for monetary positions and effects of tariffs) represent changes in the equation between supply and demand.

VII. VARIABILITY OF FARM PRICES OF WHEAT

The grain trade, whether independent or co-operative, is conducted, in theory, on a strictly differential basis. For each country point there is an established margin per bushel between the price at the country elevator and at the terminal elevator in the central market. This margin is determined primarily by freight charges, commissions, etc., which are fairly constant, though subject to change with substantial changes in freight rates, the general level of prices, or the level of particular charges, and to a small extent with changes in the price of wheat itself.[1] For the crop year, the margin probably tends to be constant. Each day the country grain buyer receives reports of cash and future prices in his central market. In the case of line elevator companies, the local manager purchases wheat on instructions fixed by the terminal price of the day, or hour, upon which he bases his local price, the margin being regarded as constant. Wheat is purchased as of grade and usually hedged in the month of the future price upon which the cash price was based. Wheat may be locally overgraded or undergraded, but this is a question that must be kept distinct from the margin between the terminal price and the country price, as of the grade. The procedure is of course the same at country points where a wheat growers' co-operative association operates or where there are elevators owned and operated by local farmers. In general it may be assumed that buying competition between line elevator companies, between private elevators locally owned, between farmers' elevators, and between farmer-owned elevators as a group and privately owned elevators as a group ought to be sufficient to insure a practically unvarying relation of country price to terminal price, as of the grade, for each country point. That is, for each country point there is the appropriate margin depending on the distance from the central market, and the country prices vary synchronously with the terminal prices for identical wheats. By synchronously is meant not the correspondence of farm and terminal prices, quotation by quotation, but day by day.

Wheat growers seem to have the impression that when terminal wheat prices decline, the movement is promptly and quantitatively reflected in the country prices; but when terminal prices rise, the movement is not promptly and quantitatively reflected in the country prices. While such a state of affairs might not be regarded as unplausible in a locality served only by privately owned elevators and without rapid dissemination of market news, it seems impossible to believe that it can now

[1] This margin is naturally more definite and stable in states producing a surplus of grain than in states which import grain. For illustration, the margin between farm prices in Kansas and terminal prices at Kansas City is more definite than between farm price in Pennsylvania and terminal price in Philadelphia.

hold in the principal wheat-growing regions. In these regions there is intense competition between grain buyers. In the country are somewhere between 4,000 and 5,000 farmer-owned elevators, most of them lying between the Alleghenies and the Rocky Mountains. At the majority of country points there is competition between farmer-owned and privately owned elevators; at some points there are only privately owned elevators, but at other points there are only farmer-owned elevators. Wheat buyers for mills canvass the hard spring- and hard winter-wheat regions extensively. Market reports of wheat prices are not only telegraphed promptly but are broadcast by radio. Under these circumstances, it is hard to believe that considerable numbers of wheat growers sell their wheat in ignorance of the terminal price. The difficulties are related not to the reflection of terminal prices back to country prices as such, but to the determination of, and agreement on, the grade and the value of their wheat for quality within the grade.

We thus arrive again at the question of the range of wheat values. Within the grade wheats are priced on milling qualities—including quantity and quality of protein, weight per bushel, yield of flour per unit, color, ash, fiber, and millability. Also, the miller must have regard for inclusion of frosted, immature, rusted, and bin-burnt kernels, which injure flour quality. Two samples of wheat of identical grade may differ in milling value from a few cents to 30 or more cents a bushel.

Not only the milling qualities within the grade, but the actual determination of the grade itself, is involved. The federal grades are coarse rather than fine and a great deal of wheat lies between grades. In practice, wheat lying between two grades is inclined to be graded down to the lower grade. This, however, depends somewhat upon competition. Where competition is intense, some wheat will be overgraded; where competition is lax, some wheat will be undergraded.

Lastly, the miller takes account of the non-wheat admixtures with the wheat. Some of these are important because they injure the flour if ground with the wheat and their removal entails expense. The milling value of two otherwise identical wheats may be several cents per bushel apart, if in one sample certain weed seeds, not easily removable, are present even in small numbers. Wheat growers as a class are not conversant with the flour-injuring properties of seeds more or less widely present in wheats, particularly those from older regions.

From all this it follows that three separate factors are involved in the reflection of terminal wheat prices to country wheat prices. One is the comparability of the grading. The second concerns the milling qualities, particularly the content of protein. The third concerns the discount to be applied to deleterious admixtures. Frequently wheat growers are not competent to judge of the quality, or even of the grade, of their wheat. The grower seeks not only to have farm price parallel terminal price for wheats of identical values, grade for grade; he seeks also to have country grading parallel terminal grading and to have country classification of value parallel terminal classification of value.

Direct information on variations in farm prices is quite inadequate for a satisfactory study. We possess an extended series of farm wheat prices, based for the year on the price of December 1. The Department of Agriculture publishes monthly and annually average producers' prices of wheat, beginning with January 1908, based on the weighted averages of prices reported by crop correspondents as of the 1st or 15th of each month. These, however, are not comparable with terminal prices, chiefly because they are prices for a single day each month and because the processes of geographical averaging themselves introduce factors distorting the series from time to time. For such reasons this series does not lend itself to a study of the variability of the farm price of wheat. Conceivably one might go back into the records of line elevators and farmer-owned elevators in the principal wheat regions and compile statistical material on day-to-day, week-to-week, month-to-month variations in country prices. But no comprehensive compilations of such prices are available for analysis.

Conclusions regarding the variability of farm prices of wheat could be expressed

in terms of comparisons of the variability of farm prices in a particular region and of wholesale prices of the same classes and grades of wheat in neighboring terminal markets. As stated, country buying, whether by private elevators or co-operatives, is uniformly conducted, in important wheat-growing districts, on the basis of margins under prices at terminal markets serving the territory. Available information on these margins as they vary from region to region and from time to time is far from complete, but it is sufficient to indicate in a broad way the character and degree of fluctuations in these margins. By combining the information on variations in margins with that on variations in terminal prices a serviceable indication could be obtained of the variations in farm prices.

Mills[1] has attempted an appraisal of the variability of farm prices contrasted with wholesale prices. For wheat he used the December 1 farm price in Kansas with the December price of wheat in Chicago. This comparison indicated a slightly larger measure of variability of farm price than of wholesale price. The greater variability of farm prices is to be expected on the theory that farm prices follow wholesale prices closely, since the measure of variability is in terms of percentage changes and a 10-cent change represents a larger percentage of the farm price than of the wholesale price.

The largest element in the margin between prices of wheat at terminal markets and prices at tributary country points in the principal wheat-growing areas is usually the freight. This element in the margin is subject to only infrequent changes, and such changes bear no relation to changes in the price of wheat except over long periods, when both move in sympathy with a sustained change in the general price level. The remainder of the margin represents the gross profit of the country elevator or other handler, co-operative or independent, and from it must be derived the principal income to cover costs of operation and net profits. The element in the margin, over and above freight, varies from place to place according to the type of elevator, according to the volume of business done, and other conditions affecting the operating cost per bushel, and according to the severity of competition. The buying margin at any one country point may vary also with the season of the year, with the condition of the market, and with the grade of the wheat.

The Federal Trade Commission, in its investigation on the grain trade, made a fairly detailed study of buying margins for wheat in the spring-wheat territory, covering the five years 1912–13 to 1916–17. Average margins for the different types of elevators stood in different relationships in the several years and exhibited no pronounced differences for the period as a whole. Margins on No. 3 Northern were uniformly slightly higher than on No. 1 Northern. The averages for the four years 1912–13 to 1915–16 ranged from 3.24 cents to 5.99 cents for No. 1 and from 3.52 cents to 8.70 cents for No. 3. If 1916–17 (clearly an abnormal year) be included, the highest annual average margins are 11.55 and 15.03 cents respectively. The margins by years were as follows:[2]

Year	Cents per bushel		Percentage of average price	
	No. 1 Northern	No. 3 Northern	No. 1 Northern	No. 3 Northern
1912–13	4.64	5.83	5.1	6.8
1913–14	3.24	3.52	3.6	4.1
1914–15	5.99	8.70	4.6	7.0
1915–16	5.50	7.26	4.6	6.5
1916–17	11.55	15.03	5.8	8.1

The average margin was found to be appreciably higher in the months of light crop movement. The seasonal variation for the crop years 1912–17 is shown in the following figures, in cents per bushel:[3]

Month	No. 1 Northern	No. 3 Northern
July	5.58	10.80
August	7.55	12.16
September	4.92	8.83
October	5.36	7.24
November	4.84	7.46
December	4.84	8.70
January	5.85	12.81
February	5.54	9.50
March	6.09	10.70
April	7.81	15.00
May	11.85	21.96
June	5.99	18.88

[1] *The Behavior of Prices*, pp. 53–54.

[2] Data from Federal Trade Commission, *Country Grain Marketing* (Report . . . . on the Grain Trade, Vol. 1), September 15, 1920, p. 195.

[3] *Op. cit.*, p. 194.

Interviews with elevator operators are summarized in the Trade Commission's report as bearing out the facts shown in the statistics above and indicating, as is suggested by the statistics, that in periods of wide fluctuations in terminal prices the elevator operator takes a wider margin. Just how he was in position to exact it was not made clear. The explanation offered was that in periods of wide fluctuations the buyer's risks are increased.

Though margins in cents per bushel were shown by these figures to be several times as large in some years as in other years, the variation in margins, expressed as a percentage of the price of wheat, is not great. Compared with the variations in terminal prices of wheat, the variations in elevators' buying margins appear small. Their variations cannot raise the variability of farm prices much above the variability of terminal prices, both expressed in cents per bushel. Expressed in percentages, the increase must appear larger, because a 10-cent change is a larger percentage of the farm price than of the terminal price. It may be questioned, however, whether the variation in margins does not tend to make farm prices more stable, expressed in cents per bushel, than terminal prices. The widening of margins in years of high prices tends to cause farm prices to rise less than terminal prices; the narrowing of margins in years of low prices tends to cause farm prices to fall less. Altogether, it appears clear that the variability of farm prices, expressed in cents per bushel, must be nearly identical with the variability of wholesale prices in the neighboring terminals.

There are reasons for doubting whether the findings of the Federal Trade Commission on variability of margins between farm price and terminal price hold for present conditions. Federal grade standards were lacking in the period covered by its study, and grading is closer nowadays. Freight car service is better than it was before the war, which makes for uniformity of margins. The cost of credit for country grain dealers is more nearly uniform than before the war. Market information is more promptly and widely disseminated than was the case twenty years ago. In short, contrasted with the pre-war period, several factors in grain handling make for uniformity in the margins representing country handling charges.

The strict method of determining the influence of the recurring seasonal movement of terminal wheat price on the weighted farm price of the crop would be to eliminate the effects of short-term fluctuations, of the secular trend, and of change in the price level. So far as we are aware, this has never been undertaken. What has been attempted, instead, has been to compare prices in the fall with those in the spring and learn whether the differences in price were more than sufficient to cover the costs of carrying the wheat over the winter.

In an earlier section we found ourselves, on the basis of available price material, unable to reach the conclusion that wheat could be routinely purchased after the harvest, stored in terminals, and sold in the spring at a profit over gross carrying charges. But it does not follow that because it is impossible thus to carry wheat over the winter at a terminal, it might not be possible to carry it over on the farm. In the year when it is possible to carry wheat in terminals from fall to spring with net profit, it would be still more easily possible to carry it with net profit on farms. In a year in which it was barely not possible with profit to carry wheat in terminals over the winter, it might be barely possible with profit to carry it over the winter on the farm. In general, the presumption would be that the possibility of carrying wheat over the winter on the farm at a net profit would be parallel to the circumstances in terminals, with some advantage in favor of the farm.

But in a different sense it is sometimes possible to carry wheat on the farm at a profit, at least over several months. In occasional years the price of September and December futures is so high in the early summer that the hard winter-wheat grower, whose crop is practically made, could sell futures for September or December (to the extent of somewhat less than his crop) and make delivery from the crop. Sometimes the spring-wheat grower can do this in the May future, when trading is first opened for that month. Or he could sell a future and buy it in when he delivers his wheat.

This is really not a form of speculation; it is a form of cash sale with deferred delivery and payment. For a trader to do this would be pure speculation, because he has not the wheat to deliver; for the grower it is not speculation because he has the wheat to deliver. It is a form of carrying wheat in expectation of a higher price, determined at once on the basis of futures. It is a regular practice of the Canadian pools.

VIII. COMPARISON OF PRE-WAR AND POST-WAR VARIATIONS

It seems to be widely believed that since the war (the post-war period regarded as beginning in July 1921) the fluctuations of wheat prices have been much more pronounced than before the war. If the change in the purchasing power of money applies to marketing and distributive services in the same manner as to goods, one might expect that fluctuations in wheat prices since the war would bear to fluctuations before the war a ratio corresponding to that of the wholesale price index numbers. This much is broadly true. Altered circumstances in the wheat trade would seem to make reasonable the expectation that fluctuations in wheat prices would be wider since the war than they were before the war, even in terms of dollars of the same purchasing power. There have been several significant shifts in the wheat price level since July 1921; and all forms of intra-seasonal price fluctuations tend to be exaggerated with a shift from one price level to another. The international trade in wheat has been greatly augmented; more countries are involved, in particular the ex-European trade has expanded; more countries are exporters and more are importers. Russia and also India have for the time being become minor figures in the world trade in wheat, European imports now come almost entirely from overseas, the exports of North America have been greatly expanded. The growth of Canadian exports has shifted the world trade toward a spring-wheat basis. The United States has been alternately on and off a price export parity for different wheats, whereby the domestic prices have been alternately exposed to foreign influence, or to some extent protected from it. The tariff has had the effect of raising domestic prices since the war, though not uniformly for all kinds of wheat. We have had federal grades of wheat since the war, and not before it. Premiums for protein have become prominent, country buying of mills has been greatly developed. These several considerations, among others, have brought it about that the domestic wheat trade is substantially different from what it was before the war. In view of these circumstances, the occasional appearance of wider price fluctuations might be regarded as not unnatural or surprising.

If one were to judge by the arithmetic means of month-to-month price changes, irrespective of the sign, as given in Table 4 (p. 257), it would seem to follow that the amplitude of the month-to-month fluctuations has increased in somewhat the same proportion as the increase in the general price level. The gross average month-to-month variation (the three American markets combined) before the war was 3.5 cents per bushel; since the war, 6.5 cents per bushel. This increase is somewhat greater than the increase of the post-war over the pre-war wholesale price index number, but it is not striking. Also, it is significant that this difference seems to hold for Canada.

But when one regards the figures for individual months more in detail, it becomes clear that the post-war averages of month-to-month price changes are the means of wider extremes than was the case before the war. A climate with a mean temperature of 70° and of which the extremes are 60° and 80° is a somewhat different climate from one with a 70° mean of which the extremes are 90° and 50°. The instances of extreme variation of price from month to month were more frequent during the post-war seven years than during the two pre-war seven-year periods. This is clearly apparent from the dispersions shown in Table 3 (p. 257). In short, while the usual plus or minus variation from month to month since the war has not been out of line with the usual plus or minus variation before the war, when adjusted for changes in price

level of wheat and in the general price level, the number of extreme fluctuations was larger after the war than before it. This conclusion is supported by reference to analysis of the price changes during the transition from one crop year to another. Outside of one extreme instance in 1909–10, the change in price from June to July at St. Louis before the war was less marked than the change from June to July since the war. The difference is not so pronounced in the Kansas City market. In the case of spring wheat at Minneapolis, the change from July to August has been more pronounced since the war than before, and this holds true still more for the spring-wheat market at Winnipeg from August to September.

Broadly considered, the monthly data disclose that what may be called the tendency to price fluctuation, when adjusted for purchasing power of money, is somewhat more pronounced since the war than before the war, and this holds for the Winnipeg market as well as for the American market. It is important to note that on the Winnipeg market, where the price of wheat is practically on the export basis, the month-to-month fluctuations, as revealed in the averages, have been even larger than in the United States. The tendency to monthly price variations in unexceptional years is not out of line with the pre-war tendency, though the price swings under exceptional circumstances have been strikingly wide.

Furthermore, the year-to-year changes in the wheat price level, when reduced to the 1913 dollar, do not seem to have been significantly larger since 1921–22 than during the fourteen crop years before the war. Indeed, in view of the extraordinary nature of developments in the markets of the world since the war, it is rather surprising that the wheat price level has not shifted back and forth to a still greater extent. Table 11 contains a summary of averages of year-to-year price deviations, adjusted to the 1913 dollar, at Minneapolis, St. Louis, and Kansas City. Judged either in terms of cents per bushel or by percentage, it seems clear that a significant change in the amplitude of year-to-year variations has not occurred. In the case of No. 1 Northern Spring wheat at Minneapolis, the year-to-year variations during 1921–28 have been smaller than during 1900–14. In the case of No. 2 Red Winter wheat at St. Louis and No. 2 Hard Winter wheat at Kansas City, the year-to-year variations have been somewhat larger since the war than before, but the difference does not seem to be of any marked significance.

In summary, neither month-to-month nor year-to-year changes in wheat prices serve to indicate that the variability of wheat prices since the war has been of a significantly different nature, or the amplitudes of a substantially different extent, than before the war.

TABLE 11.—SUMMARY OF AVERAGES OF ADJUSTED ANNUAL PRICE DEVIATIONS, 1900–01 TO 1913–14 AND 1921–22 TO 1927–28*

Item	No. 1 Northern Spring—Minneapolis		No. 2 Red Winter—St. Louis		No. 2 Hard Winter—Kansas City	
	Pre-war	Post-war	Pre-war	Post-war	Pre-war	Post-war
Average of year-to-year deviations (*cents per bushel*)	12.8	10.0	11.3	13.0	9.3	10.3
The same, as percentage of average price of period (*per cent*)	12.5	10.8	11.3	14.1	9.9	12.0
Average of yearly deviations from average price of period (*cents per bushel*)	12.1	9.0	9.0	11.0	9.6	9.0
The same, as percentage of average price of period (*per cent*)	11.8	9.7	9.0	11.9	10.2	10.5

* Based on data in Table 10, p. 279 (columns 1, 3, and 5) and Appendix Table XIV, p. 300 (columns 1, 3, and 5).

This issue is the work of Alonzo E. Taylor, with the co-operation of Joseph S. Davis and Holbrook Working and the assistance of Elizabeth Brand Taylor

TABLE I.—CLASSIFICATION OF WHEATS ON GRAIN EXCHANGES AT CHICAGO, MINNEAPOLIS, KANSAS CITY, AND ST. LOUIS*

Classification	Chicago	Minneapolis	Kansas City	St. Louis
Premium wheats	No. 1 Hard Spring—2c per bu. over contract No. 1 Dark Hard Winter—1.5c per bu. over contract No. 1 Dark Northern Spring—1c per bu. over contract No. 2 Dark Hard Winter—0.5c per bu. over contract	No. 1 Hard Spring—2c per bu. over contract No. 1 Dark Northern—1c per bu. over contract	None	None
Contract wheats	Nos. 1 and 2 Hard Winter— Nos. 1 and 2 Yellow Hard Winter— Nos. 1 and 2 Red Winter— No. 1 Northern Spring— All at contract price	No. 1 Northern Spring (See note below.)	Nos. 1 and 2 Dark Hard Winter Nos. 1 and 2 Hard Winter Nos. 1 and 2 Yellow Hard Winter	Nos. 1 and 2 Red Winter Nos. 1 and 2 Dark Hard Winter Nos. 1 and 2 Hard Winter Nos. 1 and 2 Yellow Hard Winter (Type must be specified.)
Discount wheats	No. 2 Dark Northern Spring—2c per bu. under contract No. 2 Northern Spring—3c per bu. under contract No. 3 Dark Hard Winter—5c per bu. under contract No. 3 Hard Winter—5c per bu. under contract No. 3 Yellow Hard Winter—5c per bu. under contract No. 3 Red Winter—5c per bu. under contract	No. 2 Dark Northern Spring—2c per bu. under contract No. 2 Northern Spring—3c per bu. under contract No. 3 Dark Northern Spring—18c per bu. under contract No. 3 Northern Spring—20c per bu. under contract (See note below.)	No. 3 Dark Hard Winter—5c per bu. under contract No. 3 Hard Winter—5c per bu. under contract No. 3 Yellow Hard Winter—5c per bu. under contract	No. 3 Red Winter—5c per bu. under contract No. 3 Dark Hard Winter—5c per bu. under contract No. 3 Hard Winter—5c per bu. under contract No. 3 Yellow Hard Winter—5c per bu. under contract (Type must be specified.)
Non-deliverable wheats	Nos. 3, 4, 5 and Sample, Dark Northern Spring Nos. 3, 4, 5 and Sample, Northern Spring Nos. 1, 2, 3, 4, 5 and Sample, Red Spring Nos. 4, 5 and Sample, Dark Hard Winter Nos. 4, 5 and Sample, Hard Winter Nos. 4, 5 and Sample, Yellow Hard Winter Nos. 4, 5 and Sample, Red Winter Mixed wheats	Nos. 4, 5 and Sample, Dark Northern Spring Nos. 4, 5 and Sample, Northern Spring Nos. 1, 2, 3, 4, 5 and Sample, Red Spring Mixed wheats (See note below.)	Nos. 4, 5 and Sample, Dark Hard Winter Nos. 4, 5 and Sample, Hard Winter Nos. 4, 5 and Sample Yellow Hard Winter Mixed wheats	Nos. 4, 5 and Sample, Red Winter (Provision is also made for delivery of Hard Winter wheats when so specified in the contract.)

NOTE.—Provision is also made for delivery of Hard Winter wheats when so specified in the contract

* Data from *Statistical Information Relating to Stocks, Cotton, Grain, Provisions, Live Stock and Seeds* (Howard, Bartels and Company, 1928), pp. 6-7, and from U.S. Department of Agriculture Bureau of Agricultural Economics, *Handbook of Official Grain Standards for Wheat, Shelled Corn, Oats and Rye* (August 15, 1924), pp. 5 ff.

TABLE II.—WEIGHTED AVERAGE PRICES OF REPORTED CASH SALES OF NO. 1 NORTHERN SPRING WHEAT AT MINNEAPOLIS, MONTHLY, JULY 1899 TO JUNE 1914 AND JULY 1921 TO JUNE 1928*

(Cents per bushel)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Annual averages (A)	Annual averages (B)
1899–1900....	70	70	69	69	65	65	65	65	65	66	66	71	67	67
1900–01.....	78	74	76	76	74	73	75	74	74	72	73	69	74	74
1901–02.....	65	69	68	62	70	74	76	74	72	73	75	75	71	71
1902–03.....	78	72	67	70	72	73	76	77	76	76	78	84	75	75
1903–04.....	86	93	85	82	80	82	88	97	97	93	94	94	89	89
1904–05.....	97	114	117	115	107	109	114	113	111	102	113	110	110	110
1905–06.....	108	98	81	86	84	85	83	81	77	79	83	84	86	86
1906–07.....	79	75	74	76	80	80	80	82	80	84	96	101	82	82
1907–08.....	102	100	108	112	103	107	110	106	107	103	109	108	106	106
1908–09.....	114	112	103	104	106	110	109	113	115	124	131	134	115	115
1909–10.....	129	106	104	104	105	112	114	114	115	111	110	109	109	111
1910–11.....	121	113	109	108	104	103	106	102	98	96	99	97	105	105
1911–12.....	99	105	109	110	105	102	106	106	108	110	116	113	107	107
1912–13.....	109	98	89	90	84	82	89	87	85	88	91	92	87	90
1913–14.....	91	88	87	84	85	86	87	93	92	91	94	92	88	89
1921–22.....	167	148	151	134	125	131	134	151	151	158	161	149	143	147
1922–23.....	149	111	110	115	123	125	123	126	124	130	128	117	120	123
1923–24.....	112	118	121	120	114	116	119	121	121	121	122	125	117	119
1924–25.....	137	131	130	146	148	166	189	187	171	150	167	164	156	157
1925–26.....	159	164	150	149	155	169	173	167	161	164	162	163	161	161
1926–27.....	172	149	143	149	146	146	143	142	139	138	147	149	146	147
1927–28.....	147	143	134	129	130	132	135	134	139	153	157	148	136	140

* Data from *Wheat and Rye Statistics* (U.S. Department of Agriculture Statistical Bulletin No. 12), January 1926, pp. 79–81; and *Agriculture Yearbook, 1927*, pp. 757–58, with supplementary data from current sources for 1928. The annual averages headed (A), like the monthly averages, represent daily prices weighted by sales; the column headed (B) represents an unweighted average of the monthly weighted averages.

TABLE III.—WEIGHTED AVERAGE PRICES OF REPORTED CASH SALES OF NO. 2 RED WINTER WHEAT AT ST. LOUIS, MONTHLY, JULY 1899 TO JUNE 1914 AND JULY 1921 TO JUNE 1928*

(*Cents per bushel*)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Annual averages (A)	Annual averages (B)
1899–1900....	71	71	70	72	70	71	71	72	72	72	71	77	72	72
1900–01.....	75	73	76	74	73	72	74	74	75	74	75	69	74	74
1901–02.....	66	71	71	72	74	84	89	86	82	80	81	78	73	78
1902–03.....	71	66	67	70	69	72	75	76	73	72	75	79	71	72
1903–04.....	80	81	85	87	87	92	93	104	105	106	108	107	86	95
1904–05.....	97	101	115	118	115	115	118	118	115	109	108	105	104	111
1905–06.....	89	85	86	92	92	93	94	92	91	95	94	88	90	91
1906–07.....	75	70	72	76	75	76	77	78	77	78	89	94	76	78
1907–08.....	89	87	95	103	96	100	103	102	102	99	102	96	96	98
1908–09.....	92	95	102	103	107	108	111	124	130	136	139	157	104	117
1909–10.....	113	112	114	123	122	128	130	127	123	112	116	102	113	119
1910–11.....	107	102	102	100	96	98	103	96	93	90	94	88	99	97
1911–12.....	84	88	94	100	96	97	102	101	104	113	121	111	94	101
1912–13.....	103	104	103	109	104	107	111	109	108	109	104	99	105	106
1913–14.....	85	88	94	93	94	95	96	95	95	94	96	84	89	92
1921–22.....	123	123	136	126	120	121	122	138	142	141	138	118	127	129
1922–23.....	112	109	114	123	129	136	137	139	136	139	133	123	121	128
1923–24.....	97	99	109	116	112	114	116	118	114	113	112	116	107	111
1924–25.....	135	138	140	156	163	179	210	202	186	177	186	189	159	172
1925–26.....	159	172	171	170	171	184	194	185	170	171	162	147	169	171
1926–27.....	142	134	136	140	136	137	138	135	130	129	142	150	138	137
1927–28.....	141	142	142	145	141	144	151	156	169	196	196	179	149	159

* Sources as for Table II.

TABLE IV.—WEIGHTED AVERAGE PRICES OF REPORTED CASH SALES OF NO. 2 HARD WINTER WHEAT AT KANSAS CITY, MONTHLY, JULY 1899 TO JUNE 1914 AND JULY 1921 TO JUNE 1928*

(*Cents per bushel*)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Annual averages (A)	Annual averages (B)
1899–1900....	66	65	65	65	63	64	63	64	64	64	62	66	65	64
1900–01.....	69	66	67	68	67	66	68	68	69	70	70	67	68	68
1901–02.....	63	67	66	66	69	75	79	75	72	72	74	70	68	71
1902–03.....	70	66	67	67	67	67	67	68	68	68	69	73	68	68
1903–04.....	70	73	73	73	72	71	75	87	89	89	92	89	77	79
1904–05.....	87	94	103	106	105	105	107	109	104	93	101	100	97	101
1905–06.....	84	80	78	80	81	81	81	78	76	79	80	78	80	80
1906–07.....	71	68	66	69	69	70	71	72	71	73	90	91	72	73
1907–08.....	87	86	93	100	96	97	100	95	98	97	100	97	93	96
1908–09.....	97	95	98	99	102	103	106	110	115	130	138	137	99	111
1909–10.....	114	102	102	106	104	110	111	111	110	108	107	108	107	108
1910–11.....	104	100	99	95	91	93	95	90	88	88	90	88	98	93
1911–12.....	87	93	95	104	100	100	105	103	105	109	111	109	97	102
1912–13.....	92	89	88	88	83	84	87	86	86	88	87	88	88	87
1913–14.....	82	83	87	84	83	84	85	86	88	87	90	85	84	85
1921–22.....	118	115	122	110	109	109	113	129	134	135	134	117	120	120
1922–23.....	113	104	104	113	117	117	114	115	116	120	116	104	113	113
1923–24.....	96	101	109	112	109	109	113	111	109	104	106	108	105	107
1924–25.....	120	119	120	137	143	162	182	181	171	151	163	160	135	151
1925–26.....	154	164	158	158	163	172	178	171	161	159	155	153	163	162
1926–27.....	137	131	132	139	137	138	137	135	133	131	142	144	135	136
1927–28.....	136	135	131	128	131	132	133	133	138	152	160	147	135	138

* Sources as for Table II.

TABLE V.—AVERAGES OF DAILY CASH CLOSING PRICES OF NO. 1 MANITOBA NORTHERN WHEAT AT WINNIPEG, MONTHLY, JULY 1909 TO JUNE 1914 AND JULY 1921 TO JUNE 1928*

(*Cents per bushel*)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
1909–10	131	119	100	97	97	98	103	103	104	103	98	93	104
1910–11	108	107	103	98	92	90	94	93	90	90	95	97	96
1911–12	95	101	101	100	99	95	95	97	98	101	104	106	99
1912–13	107	106	100	91	85	80	82	84	85	89	93	96	92
1913–14	97	95	89	81	83	84	85	88	90	90	93	94	89
1921–22	164	156	133	104	102	105	108	131	137	140	144	131	130
1922–23	135	117	99	101	110	108	107	110	110	119	115	112	112
1923–24	106	111	104	96	96	91	94	97	95	96	103	112	100
1924–25	135	142	142	160	164	173	196	197	176	156	182	171	166
1925–26	162	167	138	127	142	157	156	155	148	157	154	153	151
1926–27	159	151	144	143	141	134	136	140	143	145	155	161	146
1927–28	162	160	145	144	145	140	143	142	148	157	157	143	149

* Data from *Agriculture Yearbook, 1927*, p. 759, supplemented by additional data from the *Grain Trade News* (Winnipeg).

TABLE VI.—AVERAGE SPOT PRICES OF GOOD AVERAGE QUALITY RED WHEAT AT LIVERPOOL, MONTHLY, JULY 1899 TO JUNE 1914 AND JULY 1921 TO JUNE 1928*

(*Cents per bushel*)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
1899–1900	82	80	84	86	83	81	86	87	86	93	95	91	86
1900–01	91	86	91	86	87	86	89	87	87	86	86	84	87
1901–02	82	83	81	83	84	90	90	89	89	90	92	89	87
1902–03	91	91	86	85	85	88	90	91	90	89	90	91	89
1903–04	89	91	90	89	88	88	89	90	95	95	92	89	90
1904–05	89	90	...	...	...	...	...	...	101	99	97	..	95[a]
1905–06	...	...	94	96	97	96	103	103	104	99	95	95	98[b]
1906–07	96	92	91	91	90	90	89	92	92	92	98	104	93
1907–08	104	105	111	114	112	113	116	107	104	111	109	108	110
1908–09	109	108	111	112	115	116	116	121	123	132	138	134	120
1909–10	137	130	110	115	121	121	124	123	121	118	110	104	120
1910–11	108	115	112	108	104	104	107	107	...	...	103	104	107[b]
1911–12	104	104	107	108	105	107	111	115	120	123	123	122	112
1912–13	124	115	116	116	111	109	111	112	112	113	112	111	114
1913–14	110	107	104	102	104	105	102	104	107	107	111	109	106
1921–22	171[c]	159[c]	156[c]	131[c]	126[c]	137[c]	144	166	162	158	160	143	151
1922–23	152	137	132	148	148	148	148	143	140	145	149	138	144
1923–24	138	132	125	126	126	125	126	...	128	123	125	126	127[d]
1924–25	143	160	163	176	179	189	210	214	198	175	184	182	181
1925–26	176	188	180	166	171	189	183	181	164	167	173	172	176
1926–27	174	171	166	173	179	179	169[e]	169[f]	164[f]	158[f]	168[f]	180[e]	171
1927–28	176[e]	166[f]	157[e]	155[e]	155[e]	156[e]	156[f]	154[f]	155[f]	...	...	...	159[g]

* Data from *Agriculture Yearbook, 1922*, p. 601, and *1927*, p. 759. Prices for 1928 computed by Food Research Institute from Broomhall's *Corn Trade News*. Dotes (...) indicate that data are not available.

[a] Five months' average.
[b] Ten months' average.
[c] No. 2 hard winter when available, otherwise No. 2 red winter.
[d] Eleven months' average.
[e] No. 2 hard winter.
[f] No. 2 red winter.
[g] Nine months' average.

TABLE VII.—AVERAGE PRICES OF WHEAT IMPORTED INTO UNITED KINGDOM, MONTHLY, JULY 1899 TO JUNE 1914 AND JULY 1921 TO JUNE 1928*

(Cents per bushel)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Annual averages (A)	Annual averages (B)
1899–1900....	87.3	84.7	86.4	87.8	87.1	86.2	86.7	86.5	86.2	87.0	85.8	87.1	86.6	86.6
1900–01.....	90.9	88.9	90.7	91.6	90.7	89.6	89.3	89.5	89.1	87.8	88.5	87.9	89.6	89.5
1901–02.....	85.3	85.1	83.1	83.0	83.8	85.3	88.4	87.2	88.2	84.5	90.3	88.8	86.2	86.1
1902–03.....	88.7	86.6	86.3	85.1	85.1	87.0	87.4	90.0	90.5	87.5	89.5	88.5	87.6	87.7
1903–04.....	88.2	87.7	88.4	88.6	88.6	87.6	88.5	90.0	92.4	90.4	89.6	89.2	89.1	89.1
1904–05.....	88.1	90.7	93.1	93.2	93.9	94.9	94.2	94.0	95.2	93.5	93.9	94.9	93.3	93.3
1905–06.....	92.9	92.9	92.8	94.3	96.3	96.7	97.1	96.6	94.2	93.0	93.4	92.1	94.0	94.4
1906–07.....	91.4	90.5	88.9	88.3	88.2	88.0	89.0	90.4	89.9	89.5	92.6	97.4	90.8	90.3
1907–08.....	99.5	101.2	106.1	114.8	116.5	116.1	116.6	112.1	107.3	105.4	107.8	104.5	108.3	109.0
1908–09.....	107.1	107.4	110.7	112.4	111.9	113.6	112.8	112.7	115.9	119.7	127.0	127.8	115.3	114.9
1909–10.....	130.3	126.4	121.2	115.0	116.5	116.8	117.6	118.7	118.1	116.7	112.0	103.8	117.7	117.8
1910–11.....	104.1	107.1	108.0	107.1	103.4	102.0	102.9	103.4	103.2	101.2	101.0	100.8	103.7	103.7
1911–12.....	99.5	101.8	105.0	108.1	108.5	106.8	107.8	109.8	112.0	113.1	111.3	109.5	107.6	107.8
1912–13.....	109.2	109.6	108.5	112.9	112.3	108.8	110.2	109.3	110.6	110.1	109.7	109.9	110.1	110.1
1913–14.....	109.3	107.8	107.1	104.9	102.8	101.9	102.7	103.2	104.6	104.6	106.2	106.5	105.4	105.1
1921–22.....	174.2	165.5	164.0	160.7	143.0	142.8	135.9	139.2	149.3	154.7	156.8	154.1	154.5	153.4
1922–23.....	149.2	145.4	132.9	130.9	135.8	141.6	142.6	140.4	138.0	136.9	140.2	138.5	139.7	139.4
1923–24.....	132.2	126.6	121.2	119.8	118.1	118.1	115.6	121.2	122.5	123.0	121.1	121.4	122.1	121.7
1924–25.....	127.4	143.2	149.4	161.9	174.8	182.3	192.8	203.2	203.1	193.9	187.6	188.1	171.4	175.6
1925–26.....	178.0	176.3	176.5	160.5	157.4	164.5	174.9	178.6	171.5	168.7	169.1	170.3	170.4	170.5
1926–27.....	170.8	167.9	165.0	163.4	170.3	167.5	165.5	161.5	160.1	158.1	160.5	162.8	164.3	164.4
1927–28.....	163.3	163.6	162.7	157.3	153.9	154.6	149.8	151.0	147.4	153.9	155.9	154.5	155.7	155.7

* Data from *Accounts Relating to Trade and Navigation of the United Kingdom.* Pre-war prices converted to U.S. dollars at par; post-war prices converted at monthly average exchange rates.

TABLE VIII.—DEVIATIONS OF MONTHLY WEIGHTED AVERAGE PRICES OF REPORTED CASH SALES OF NO. 1 NORTHERN SPRING WHEAT AT MINNEAPOLIS FROM AVERAGE PRICE OF PREVIOUS MONTH, PRE-WAR AND POST-WAR*

(Cents per bushel)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Aver-age
1900–01	+ 7	— 4	+ 2	0	— 2	— 1	+ 2	— 1	0	— 2	+ 1	— 4	2.2
1901–02	— 4	+ 4	— 1	— 6	+ 8	+ 4	+ 2	— 2	— 2	+ 1	+ 2	0	3.0
1902–03	+ 3	— 6	— 5	+ 3	+ 2	+ 1	+ 3	+ 1	— 1	0	+ 2	+ 6	2.8
1903–04	+ 2	+ 7	— 8	— 3	— 2	+ 2	+ 6	+ 9	0	— 4	+ 1	0	3.7
1904–05	+ 3	+17	+ 3	— 2	— 8	+ 2	+ 5	— 1	— 2	— 9	+11	— 3	5.5
1905–06	— 2	—10	—17	+ 5	— 2	+ 1	— 2	— 2	— 4	+ 2	+ 4	+ 1	4.3
1906–07	— 5	— 4	— 1	+ 2	+ 4	0	0	+ 2	— 2	+ 4	+12	+ 5	3.4
Average	3.7	7.4	5.3	3.0	4.0	1.6	2.9	2.6	1.6	3.1	4.7	2.7	3.6
1907–08	+ 1	— 2	+ 8	+ 4	— 9	+ 4	+ 3	— 4	+ 1	— 4	+ 6	— 1	3.9
1908–09	+ 6	— 2	— 9	+ 1	+ 2	+ 4	— 1	+ 4	+ 2	+ 9	+ 7	+ 3	4.2
1909–10	— 5	—23	— 2	0	+ 1	+ 7	+ 2	0	+ 1	— 4	— 1	— 1	3.9
1910–11	+12	— 8	— 4	— 1	— 4	— 1	+ 3	— 4	— 4	— 2	+ 3	— 2	4.0
1911–12	+ 2	+ 6	+ 4	+ 1	— 5	— 3	+ 4	0	+ 2	+ 2	+ 6	— 3	3.2
1912–13	— 4	—11	— 9	+ 1	— 6	— 2	+ 7	— 2	— 2	+ 3	+ 3	+ 1	4.2
1913–14	— 1	— 3	— 1	— 3	+ 1	+ 1	+ 1	+ 6	— 1	— 1	+ 3	— 2	2.0
Average	4.4	7.9	5.3	1.6	4.0	3.1	3.0	2.9	1.9	3.6	4.1	1.9	3.6
1921–22	— 2	—19	+ 3	—17	— 9	+ 6	+ 3	+17	0	+ 7	+ 3	—12	8.2
1922–23	0	—38	— 1	+ 5	+ 8	+ 2	— 2	+ 3	— 2	+ 6	— 2	—11	6.7
1923–24	— 5	+ 6	+ 3	— 1	— 6	+ 2	+ 3	+ 2	0	0	+ 1	+ 3	2.7
1924–25	+12	— 6	— 1	+16	+ 2	+18	+23	— 2	—16	—21	+17	— 3	11.4
1925–26	— 5	+ 5	—14	— 1	+ 6	+14	+ 4	— 6	— 6	+ 3	— 2	+ 1	5.6
1926–27	+ 9	—23	— 6	+ 6	— 3	0	— 3	— 1	— 3	— 1	+ 9	+ 2	4.7
1927–28	— 2	— 4	— 9	— 5	+ 1	+ 2	+ 3	— 1	+ 5	+14	+ 4	— 9	4.9
Average	5.0	14.4	5.3	7.3	5.0	6.3	5.9	4.6	4.6	7.4	5.4	5.9	6.3

* Based on data in Table II. The averages for the crop years and for the seven-year periods are computed without regard to the plus and minus signs.

TABLE IX.—DEVIATIONS OF MONTHLY WEIGHTED AVERAGE PRICES OF REPORTED CASH SALES OF NO. 2 RED WINTER WHEAT AT ST. LOUIS FROM AVERAGE PRICE OF PREVIOUS MONTH, PRE-WAR AND POST-WAR*

(Cents per bushel)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
1900–01	— 2	— 2	+ 3	— 2	— 1	— 1	+ 2	0	+ 1	— 1	+ 1	— 6	1.8
1901–02	— 3	+ 5	0	+ 1	+ 2	+10	+ 5	— 3	— 4	— 2	+ 1	— 3	3.3
1902–03	— 7	— 5	+ 1	+ 3	— 1	+ 3	+ 3	+ 1	— 3	— 1	+ 3	+ 4	2.9
1903–04	+ 1	+ 1	+ 4	+ 2	0	+ 5	+ 1	+11	+ 1	+ 1	+ 2	— 1	2.5
1904–05	—10	+ 4	+14	+ 3	— 3	0	+ 3	0	— 3	— 6	— 1	— 3	4.2
1905–06	—16	— 4	+ 1	+ 6	0	+ 1	+ 1	— 2	— 1	+ 4	— 1	— 6	3.6
1906–07	—13	— 5	+ 2	+ 4	— 1	+ 1	+ 1	+ 1	— 1	+ 1	+11	+ 5	3.8
Average	7.4	3.7	3.6	3.0	1.1	3.0	2.3	2.6	2.0	2.3	2.9	4.0	3.2
1907–08	— 5	— 2	+ 8	+ 8	— 7	+ 4	+ 3	— 1	0	— 3	+ 3	— 6	4.2
1908–09	— 4	+ 3	+ 7	+ 1	+ 4	+ 1	+ 3	+13	+ 6	+ 6	+ 3	+18	5.8
1909–10	—44	— 1	+ 2	+ 9	— 1	+ 6	+ 2	— 3	— 4	—11	+ 4	—14	8.4
1910–11	+ 5	— 5	0	— 2	— 4	+ 2	+ 5	— 7	— 3	— 3	+ 4	— 6	3.8
1911–12	— 4	+ 4	+ 6	+ 6	— 4	+ 1	+ 5	— 1	+ 3	+ 9	+ 8	—10	5.1
1912–13	— 8	+ 1	— 1	+ 6	— 5	+ 3	+ 4	— 2	— 1	+ 1	— 5	— 5	3.5
1913–14	—14	+ 3	+ 6	— 1	+ 1	+ 1	+ 1	— 1	0	— 1	+ 2	—12	3.6
Average	12.0	2.7	4.3	4.7	3.7	2.6	3.3	4.0	2.4	4.9	4.1	10.1	4.9
1921–22	—27	0	+13	—10	— 6	+ 1	+ 1	+16	+ 4	— 1	— 3	—20	8.5
1922–23	— 6	— 3	+ 5	+ 9	+ 6	+ 7	+ 1	+ 2	— 3	+ 3	— 6	—10	5.1
1923–24	—26	+ 2	+10	+ 7	— 4	+ 2	+ 2	+ 2	— 4	— 1	— 1	+ 4	5.4
1924–25	+19	+ 3	+ 2	+16	+ 7	+16	+31	— 8	—16	— 9	+ 9	+ 3	11.6
1925–26	—30	+13	— 1	— 1	+ 1	+13	+10	— 9	—15	+ 1	— 9	—15	9.8
1926–27	— 5	— 8	+ 2	+ 4	— 4	+ 1	+ 1	— 3	— 5	— 1	+13	+ 8	4.6
1927–28	— 9	+ 1	0	+ 3	— 4	+ 3	+ 7	+ 5	+13	+27	0	—17	7.4
Average	17.4	4.3	4.7	7.1	4.6	6.1	7.6	6.4	8.6	6.1	5.9	11.0	7.5

* Based on data in Table III. Averages computed without regard to plus and minus signs.

TABLE X.—DEVIATIONS OF MONTHLY WEIGHTED AVERAGE PRICES OF REPORTED CASH SALES OF NO. 2 HARD WINTER WHEAT AT KANSAS CITY FROM AVERAGE PRICE OF PREVIOUS MONTH, PRE-WAR AND POST-WAR*

(Cents per bushel)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Aver-age
1900–01	+ 3	— 3	+ 1	+ 1	— 1	— 1	+ 2	0	+ 1	+ 1	0	— 3	1.4
1901–02	— 4	+ 4	— 1	0	+ 3	+ 6	+ 4	— 4	— 3	0	+ 2	— 4	2.9
1902–03	0	— 4	+ 1	0	0	0	0	+ 1	0	0	+ 1	+ 4	0.9
1903–04	— 3	+ 3	0	0	— 1	— 1	+ 4	+12	+ 2	0	+ 3	— 3	2.7
1904–05	— 2	+ 7	+ 9	+ 3	— 1	0	+ 2	+ 2	— 5	—11	+ 8	— 1	4.2
1905–06	—16	— 4	— 2	+ 2	+ 1	0	0	— 3	— 2	+ 3	+ 1	— 2	3.0
1906–07	— 7	— 3	— 2	+ 3	0	+ 1	+ 1	+ 1	— 1	+ 2	+17	+ 1	3.2
Average	5.0	4.0	2.3	1.3	1.0	1.3	1.9	3.3	2.0	2.4	4.6	2.6	2.6
1907–08	— 4	— 1	+ 7	+ 7	— 4	+ 1	+ 3	— 5	+ 3	— 1	+ 3	— 3	3.5
1908–09	0	— 2	+ 3	+ 1	+ 3	+ 1	+ 3	+ 4	+ 5	+15	+ 8	— 1	3.8
1909–10	—23	—12	0	+ 4	— 2	+ 6	+ 1	0	— 1	— 2	— 1	+ 1	4.4
1910–11	— 4	— 4	— 1	— 4	— 4	+ 2	+ 2	— 5	— 2	0	+ 2	— 2	2.7
1911–12	— 1	+ 6	+ 2	+ 9	— 4	0	+ 5	— 2	+ 2	+ 4	+ 2	— 2	3.2
1912–13	—17	— 3	— 1	0	— 5	+ 1	+ 3	— 1	0	+ 2	— 1	+ 1	2.9
1913–14	— 6	+ 1	+ 4	— 3	— 1	+ 1	+ 1	+ 1	+ 2	— 1	+ 3	— 5	2.4
Average	7.9	4.1	2.6	4.0	3.3	1.7	2.6	2.6	2.1	3.6	2.9	2.1	3.3
1921–22	—20	— 3	+ 7	—12	— 1	0	+ 4	+16	+ 5	+ 1	— 1	—17	7.2
1922–23	— 4	— 9	0	+ 9	+ 4	0	— 3	+ 1	+ 1	+ 4	— 4	—12	4.2
1923–24	— 8	+ 5	+ 8	+ 3	— 3	0	+ 4	— 2	— 2	— 5	+ 2	+ 2	3.7
1924–25	+12	— 1	+ 1	+17	+ 6	+19	+20	— 1	—10	—20	+12	— 3	10.2
1925–26	— 6	+10	— 6	0	+ 5	+ 9	+ 6	— 7	—10	— 2	— 4	— 2	5.6
1926–27	—16	— 6	+ 1	+ 7	— 2	+ 1	— 1	— 2	— 2	— 2	+11	+ 2	4.4
1927–28	— 8	— 1	— 4	— 3	+ 3	+ 1	+ 1	0	+ 5	+14	+ 8	—13	5.1
Average	10.6	5.0	3.9	7.3	3.4	4.3	5.6	4.1	5.0	6.9	6.0	7.3	5.8

* Based on data in Table IV. Averages computed without regard to plus and minus signs.

TABLE XI.—DEVIATIONS OF MONTHLY AVERAGE CLOSING PRICES OF NO. 1 MANITOBA NORTHERN WHEAT AT WINNIPEG FROM AVERAGE PRICE OF PREVIOUS MONTH, PRE-WAR AND POST-WAR*

(Cents per bushel)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Aver-age
1909–10	....	—12	—19	— 3	0	+ 1	+ 5	0	+ 1	— 1	— 5	— 5	4.7[a]
1910–11	+15	— 1	— 4	— 5	— 6	— 2	+ 4	— 1	— 3	0	+ 5	+ 2	4.0
1911–12	— 2	+ 6	0	— 1	— 1	— 4	0	+ 2	+ 1	+ 3	+ 3	+ 2	2.1
1912–13	+ 1	— 1	— 6	— 9	— 6	— 5	+ 2	+ 2	+ 1	+ 4	+ 4	+ 3	3.7
1913–14	+ 1	— 2	— 6	— 8	+ 2	+ 1	+ 1	+ 3	+ 2	0	+ 3	+ 1	2.5
Average	4.8	4.4	7.0	5.2	3.0	2.6	2.4	1.6	1.6	1.6	4.0	2.6	3.4
1921–22	— 5	— 8	—23	—29	— 2	+ 3	+ 3	+23	+ 6	+ 3	+ 4	—13	10.2
1922–23	+ 4	—18	—18	+ 2	+ 9	— 2	— 1	+ 3	0	+ 9	— 4	— 3	6.1
1923–24	— 6	+ 5	— 7	— 8	0	— 5	+ 3	+ 3	— 2	+ 1	+ 7	+ 9	4.7
1924–25	+23	+ 7	0	+18	+ 4	+ 9	+23	+ 1	—21	—20	+26	—11	13.6
1925–26	— 9	+ 5	—29	—11	+15	+15	— 1	— 1	— 7	+ 9	— 3	— 1	8.8
1926–27	+ 6	— 8	— 7	— 1	— 2	— 7	+ 2	+ 4	+ 3	+ 2	+10	+ 6	4.8
1927–28	+ 1	— 2	—15	— 1	+ 1	— 5	+ 3	— 1	+ 6	+ 9	0	—14	4.8
Average	7.7	7.6	14.1	10.0	4.7	6.6	5.1	5.1	6.4	7.6	7.7	8.1	7.6

* Based on data in Table V. Averages computed without regard to plus and minus signs.

[a] Eleven months' average.

TABLE XII.—DEVIATIONS OF MONTHLY AVERAGE PRICES OF RED WHEAT AT LIVERPOOL FROM AVERAGE PRICE OF PREVIOUS MONTH, PRE-WAR AND POST-WAR*

(Cents per bushel)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Average
1900–01.....	0	— 5	+ 5	— 5	+ 1	— 1	+ 3	— 2	0	— 1	0	— 2	2.1
1901–02.....	— 2	+ 1	— 2	+ 2	+ 1	+ 6	0	— 1	0	+ 1	+ 2	— 3	1.8
1902–03.....	+ 2	0	— 5	— 1	0	+ 3	+ 2	+ 1	— 1	— 1	+ 1	+ 1	1.5
1903–04.....	— 2	+ 2	— 1	— 1	— 1	0	+ 1	+ 1	+ 5	0	— 3	— 3	1.7
1904–05.....	0	+ 1	....	....	....	....	....	....	....	— 2	— 2	....	1.2[a]
1905–06.....	....	....	....	+ 2	+ 1	— 1	+ 7	0	+ 1	— 5	— 4	0	2.3[b]
1906–07.....	+ 1	— 4	— 1	0	— 1	0	— 1	+ 3	0	0	+ 6	+ 6	1.9
Average....	1.2	2.2	2.8	1.8	0.8	1.8	2.3	1.3	1.2	1.4	2.6	2.5	1.8
1907–08.....	0	+ 1	+ 6	+ 3	— 2	+ 1	+ 3	— 9	— 3	+ 7	— 2	— 1	3.2
1908–09.....	+ 1	— 1	+ 3	+ 1	+ 3	+ 1	0	+ 5	+ 2	+ 9	+ 6	— 4	3.0
1909–10.....	+ 3	— 7	—20	+ 5	+ 6	0	+ 3	— 1	— 2	— 3	— 8	— 6	5.3
1910–11.....	+ 4	+ 7	— 3	— 4	— 4	0	+ 3	0	....	....	....	+ 1	2.9[b]
1911–12.....	0	0	+ 3	+ 1	— 3	+ 2	+ 4	+ 4	+ 5	+ 3	0	— 1	2.2
1912–13.....	+ 2	— 9	+ 1	0	— 5	— 2	+ 2	+ 1	0	+ 1	— 1	— 1	2.1
1913–14.....	— 1	— 3	— 3	— 2	+ 2	+ 1	— 3	+ 2	+ 3	0	+ 4	— 2	2.2
Average....	1.6	4.0	5.6	2.3	3.6	1.0	2.6	3.1	2.5	3.8	3.5	2.3	3.0
1921–22.....	—25	—12	— 3	—25	— 5	+11	+ 7	+22	— 4	— 4	+ 2	—17	11.4
1922–23.....	+ 9	—15	— 5	+16	0	0	0	— 5	— 3	+ 5	+ 4	—11	6.1
1923–24.....	0	— 6	— 7	+ 1	0	— 1	+ 1	....	....	— 5	+ 2	+ 1	2.4[c]
1924–25.....	+17	+17	+ 3	+13	+ 3	+10	+21	+ 4	—16	—23	+ 9	— 2	11.5
1925–26.....	— 6	+12	— 8	—14	+ 5	+18	— 6	— 2	—17	+ 3	+ 6	— 1	8.2
1926–27.....	+ 2	— 3	— 5	+ 7	+ 6	0	—10	0	— 5	— 6	+10	+12	5.5
1927–28.....	— 4	—10	— 9	— 2	0	+ 1	0	— 2	+ 1	....	....	....	3.2[b]
Average....	9.0	10.7	5.7	11.1	2.7	5.9	6.4	5.8	7.7	7.7	5.5	7.3	7.2

* Based on data in Table VI. Averages computed without regard to plus and minus signs.

[a] Four months' average.

[b] Nine months' average.

[c] Ten months' average.

TABLE XIII.—DEVIATIONS OF MONTHLY AVERAGE PRICES OF WHEAT IMPORTS INTO UNITED KINGDOM FROM AVERAGE PRICE OF PREVIOUS MONTH, PRE-WAR AND POST-WAR*

(Cents per bushel)

Crop year July–June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Aver-age
1900–01	+ 3.8	— 2.0	+ 1.8	+ 0.9	— 0.9	— 1.1	— 0.3	+ 0.2	— 0.4	— 1.3	+ 0.7	— 0.6	1.2
1901–02	— 2.6	— 0.2	— 2.0	— 0.1	+ 0.8	+ 1.5	+ 3.1	— 1.2	+ 1.0	— 3.7	+ 5.8	— 1.5	2.0
1902–03	— 0.1	— 2.1	— 0.3	— 1.2	0.0	+ 1.9	+ 0.4	+ 2.6	+ 0.5	— 3.0	+ 2.0	— 1.0	1.2
1903–04	— 0.3	— 0.5	+ 0.7	+ 0.2	0.0	— 1.0	+ 0.9	+ 1.5	+ 2.4	- 2.0	— 0.8	— 0.4	0.8
1904–05	— 1.1	+ 2.6	+ 2.4	+ 0.1	+ 0.7	+ 1.0	— 0.7	— 0.2	+ 1.2	- 1.7	+ 0.4	+ 1.0	1.1
1905–06	— 2.0	0.0	— 0.1	+ 1.5	+ 2.0	+ 0.4	+ 0.4	— 0.5	— 2.4	— 1.2	+ 0.4	— 1.3	1.0
1906–07	— 0.7	— 0.9	— 1.6	— 0.6	— 0.1	- 0.2	+ 1.0	+ 1.4	— 0.5	— 0.4	+ 3.1	+ 4.8	1.3
Average	1.5	1.2	1.1	0.6	0.6	1.0	1.0	1.1	1.2	1.9	1.9	1.5	1.2
1907–08	+ 2.1	+ 1.7	+ 4.9	+ 8.7	+ 1.7	— 0.4	+ 0.5	— 4.5	— 4.8	— 1.9	+ 2.4	— 3.3	3.1
1908–09	+ 2.6	+ 0.3	+ 3.3	+ 1.7	— 0.5	+ 1.7	— 0.8	— 0.1	+ 3.2	+ 3.8	+ 7.3	+ 0.8	2.2
1909–10	+ 2.5	— 3.9	— 5.2	— 6.2	+ 1.5	+ 0.3	+ 0.8	+ 1.1	— 0.6	— 1.4	— 4.7	— 8.2	3.0
1910–11	+ 0.3	+ 3.0	+ 0.9	— 0.9	— 3.7	- 1.4	+ 0.9	+ 0.5	— 0.2	— 2.0	— 0.2	— 0.2	1.2
1911–12	— 1.3	+ 2.3	+ 3.2	+ 3.1	+ 0.4	— 1.7	+ 1.0	+ 2.0	+ 2.2	+ 1.1	— 1.8	— 1.8	1.8
1912–13	— 0.3	+ 0.4	— 1.1	+ 4.4	— 0.6	— 3.5	+ 1.4	- 0.9	+ 1.3	— 0.5	— 0.4	+ 0.2	1.3
1913–14	— 0.6	— 1.5	— 0.7	— 2.2	— 2.1	— 0.9	+ 0.8	+ 0.5	+ 1.4	0.0	+ 1.6	+ 0.3	1.0
Average	1.4	1.9	2.8	3.9	1.5	1.4	0.9	1.4	1.9	1.5	2.6	2.1	1.9
1921–22	— 8.1	— 8.7	— 1.5	— 3.3	—17.7	- 0.2	— 6.9	+ 3.3	+10.1	+ 5.4	+ 2.1	— 2.7	5.8
1922–23	— 4.9	— 3.8	—12.5	— 2.0	+ 4.9	+ 5.8	+ 1.0	— 2.2	— 2.4	— 1.1	+ 3.3	— 1.7	3.8
1923–24	— 6.3	— 5.6	— 5.4	— 1.4	— 1.7	0.0	— 2.5	+ 5.6	+ 1.3	+ 0.5	— 1.9	+ 0.3	2.7
1924–25	+ 6.0	+15.8	+ 6.2	+12.5	+12.9	+ 7.5	+10.5	+10.4	— 0.1	— 9.2	— 6.3	+ 0.5	8.2
1925–26	—10.1	— 1.7	+ 0.2	—16.0	— 3.1	+ 7.1	+10.4	+ 3.7	— 7.1	— 2.8	+ 0.4	+ 1.2	5.3
1926–27	+ 0.5	— 2.9	— 2.9	— 1.6	+ 6.9	— 2.8	— 2.0	— 4.0	— 1.4	— 2.0	+ 2.4	+ 2.3	2.6
1927–28	+ 0.5	+ 0.3	— 0.9	— 5.4	— 3.4	+ 0.7	— 4.8	+ 1.2	— 3.6	+ 6.5	+ 2.0	— 1.4	2.6
Average	5.2	5.5	4.2	6.0	7.2	3.4	5.4	4.3	3.7	3.9	2.6	1.4	4.4

* Based on data in Table VII. Averages computed without regard to plus and minus signs.

TABLE XIV.—DEVIATIONS OF ADJUSTED ANNUAL AVERAGE PRICES FROM CORRESPONDING PRICES OF PREVIOUS YEAR, PRE-WAR AND POST-WAR*

(Cents per bushel)

Crop year July–June	No. 1 Northern Spring—Minneapolis		No. 2 Red Winter—St. Louis		No. 2 Hard Winter—Kansas City		Wheat exports from U.S. to Europe	No. 1 Manitoba Northern—Winnipeg	Average quality, red, spot—Liverpool	Wheat imports into United Kingdom	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(B)	(A)	(B)
1900–01.....	+10	+10	+ 4	+ 4	+ 5	+ 6	+ 3	..	+ 2	+ 5	+ 4
1901–02.....	— 7	— 7	— 4	+ 3	— 2	+ 1	— 3	..	— 3	— 8	— 7
1902–03.....	0	0	— 8	—13	— 5	— 8	— 2	..	— 4	— 5	— 5
1903–04.....	+18	+18	+19	+29	+12	+15	+ 7	..	+ 3	+ 4	+ 4
1904–05.....	+23	+23	+20	+17	+22	+24	+ 8	..	+ 4	+ 3	+ 3
1905–06.....	—29	—29	—17	—24	—21	—26	— 9	..	+ 3	0	+ 1
1906–07.....	— 9	— 9	—21	—19	—13	—12	— 7	..	—11	— 8	—10
Average...	13.7	13.7	13.3	15.6	11.4	13.1	5.6	..	4.3	4.7	4.9
1907–08.....	+26	+26	+22	+21	+23	+24	+23	..	+18	+18	+20
1908–09.....	+ 8	+ 7	+ 7	+19	+ 5	+15	0	..	+ 9	+ 6	+ 5
1909–10.....	—17	—13	— 1	— 9	— 2	—13	— 9	..	—11	— 8	— 8
1910–11.....	+ 3	0	— 7	—15	— 2	— 8	— 3	— 1	— 6	— 7	— 7
1911–12.....	+ 2	+ 2	— 6	+ 3	— 2	+ 8	0	+ 2	+ 5	+ 3	+ 4
1912–13.....	—25	—22	+ 7	+ 1	—13	—19	0	—11	— 3	— 2	— 3
1913–14.....	+ 2	0	—15	—13	— 3	— 1	— 1	— 2	— 7	— 4	— 4
Average...	11.9	10.0	9.3	11.6	7.1	12.6	5.1	4.0	8.4	6.9	7.3
1921–22.....	..[a]	..[a]	..[a]	..[a]	..[a]	..[a]	..[a]	..[a]	..[a]	..[a]	..[a]
1922–23.....	—23	—24	—11	— 9	—11	—13	—15	—19	—14	—19	—18
1923–24.....	+ 1	0	— 7	— 8	— 3	— 1	— 6	— 5	— 8	— 9	— 9
1924–25.....	+23	+23	+32	+37	+17	+26	+29	+40	+33	+30	+32
1925–26.....	+ 2	+ 2	+ 6	— 1	+18	+ 7	— 2	—10	— 4	— 2	— 3
1926–27.....	— 4	— 4	—15	—17	—13	—11	— 2	+ 2	+ 3	+ 3	+ 2
1927–28.....	— 7	— 5	+ 7	+15	0	+ 1	— 4	+ 2	— 8	— 6	— 6
Average...	10.0	9.7	13.0	14.5	10.3	9.8	9.7	13.0	11.7	11.5	11.7

* Based on data in Table 10. The columns headed (A) represent deviations of adjusted weighted average annual prices; the columns headed (B) represent deviations of adjusted unweighted annual averages of monthly weighted average prices. Averages computed without regard to plus and minus signs.

[a] Deviations of prices for the year 1921–22 from those for 1920–21 are omitted because of the deflation of prices in that year.

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WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 8 JULY 1929

THE EXPORT DEBENTURE PLAN FOR WHEAT

THE farm export debenture scheme is an ingenious proposal to supplement our protective tariff by a system of export bounties on farm products of which we produce export surpluses. The bounties would be payable in "debentures" receivable for customs duties. The proponents reason that debenture rates will be reflected back to farm prices, thereby contributing greatly to farmer prosperity and "equality for agriculture."

Our analysis of the plan, as it might be applied to wheat and flour, leads to the conclusion that the results would be highly disappointing. Even in the early stages, farm prices of wheat would be raised by less than the debenture rate. Under the stimulus of expected and realized price increases, production would expand. Consequent expansion of exports would cause declines in world prices, thereby minimizing the enhancement of domestic prices. Ensuing readjustments in acreage, here and abroad, would lead to an equilibrium in which price benefits to American wheat growers would be only moderate, even in the absence of foreign retaliation. Some reprisals are likely; and so far as these materialized, they would reduce the farm price enhancement otherwise possible. Higher prices to farmers as consumers, substantial costs to the Treasury, disturbances to agriculture, industry, and trade, and international complications would tend to offset the gains from limited increases in farm prices.

Pertinent foreign experience with analogous devices tends to bear out this reasoning. The reputation of the debenture plan might be better or worse than accurate appraisal would warrant, for its actual results would be hard to disentangle; but we are convinced that hopes of substantial benefits from its application are illusory.

STANFORD UNIVERSITY, CALIFORNIA

July 1929

WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

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Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.
Published by Stanford University for the Food Research Institute.

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FOOD RESEARCH INSTITUTE

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THE EXPORT DEBENTURE PLAN FOR WHEAT

INTRODUCTION

The farm export debenture plan was first presented to Congress early in 1926, in bills introduced by Senator McKinley and Congressman Adkins of Illinois. Professor Charles L. Stewart of the University of Illinois was the author of the plan, and has been most assiduous in developing the proposal and the case for its adoption. Vigorously and persistently advocated by the National Grange, since late in 1926, as a major element in its program for restoring agricultural prosperity in the United States, it has gradually won increasing recognition and support.

Early in 1927, near the close of the Sixty-ninth Congress, Representative Marvin Jones of Texas, who had been the author of earlier export bounty bills, introduced his first export debenture bill. In 1928 the plan was embodied in several bills introduced by Mr. Jones and by Representative Ketcham of Michigan, a former lecturer of the National Grange. A compromise debenture bill (H.R. 12892), which included a number of features in common with the McNary-Haugen bill, was rejected by the House in favor of the latter, on May 3, 1928, by a vote of 185 to 146. During the spring of 1929, in the Senate's consideration of farm relief measures, the debenture plan came strongly to the fore. It gained support from previous backers of the equalization fee plan, who despaired of securing the adoption of their favorite scheme in the face of Mr. Hoover's outspoken condemnation of it during the presidential campaign; and from these and others who were dissatisfied with the different and seemingly milder measure favored by the President.

The House bill for farm relief (H.R. 1), drafted in fullfilment of the administration's pledges and passed on April 25, 1929, at no stage included debenture provisions. The Senate Committee on Agriculture and Forestry, however, wrote the plan into the McNary bill (S. 1, Sec. 10), and voted 8 to 6 (with Senator McNary voting against it) to retain it even after receiving, on April 20, a strongly adverse communication from President Hoover. After considerable debate in the Senate, a motion of Senator Watson to eliminate this section from the bill was defeated on May 8, by a vote of 47 to 44; and the bill including this section was passed on May 14, by a vote of 58 to 33. When the joint conference committee returned the compromise bill without the debenture plan, the Senate, on June 11, rejected the committee's report by a vote of 46 to 43. A roll call in the House was the only means of breaking the deadlock. This was taken, without debate, on June 13. The House voted 250 to 113 to instruct its conferees to insist on the elimination of the plan. Thereupon the Senate conceded the point and passed the Agricultural Marketing Act without the section providing for export debentures.

Though defeated for the present, the debenture plan is by no means killed. The recent votes in the Senate and House give an inadequate measure of the political support for the plan. The power and prestige of the new President—on the morrow of his election by a decisive majority, after a campaign in which he had stressed other measures for aid to agriculture—held in line many regular Republicans in both House and Senate who would probably have voted for the plan if he had not condemned it so emphatically and given reason to expect that he would veto a farm bill otherwise satisfactory to him if it contained debenture provisions. The hearings and recent debates have disclosed a well-knit and powerful case for the proposal. While reasoned opposition has lately been presented, it may be doubted whether any of the ardent advocates of the measure was converted and whether many of the neu-

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trals were transformed into genuine opponents of the measure on its merits. Senator Norris, indeed, soon introduced the debenture plan as an amendment to the tariff bill now before the Senate, and a vote on this amendment will presumably be taken in the early fall. Even if the plan is again defeated then, we may expect further pressure for its adoption unless or until other measures taken prove adequate to allay agrarian agitation, or the plan itself is recognized as unworthy of adoption. Under these circumstances an analysis of the plan is something more than a mere academic exercise.

In the discussions of the plan, wheat has figured more prominently than any other commodity; and it ranks second only to cotton among the farm products which proponents of the measure expect to yield the most benefit to producers under the operation of the scheme. It is therefore appropriate to include in WHEAT STUDIES an examination of the export debenture plan, with special reference to its possible application to wheat and flour.

I. THE PLAN AND THE THEORY

The avowed object of the debenture plan is to raise farm prices of agricultural products of which the United States produces export surpluses. It seeks to "make the tariff effective," at least in large part, by establishing domestic farm prices on a level substantially higher than would be determined under the usual conditions in which our exports compete without favor in the world markets. In these respects it is similar to the equalization fee plan. It rests, indeed, upon much the same reasoning: that farmers fail to get their due share of benefits under our existing protective system; that farming is inadequately remunerative because farmers have to sell so many of their products at prices determined in world markets, while they must buy goods and services whose prices are elevated in consequence of our protective system; and that direct measures are called for to extend to farmers the benefits of protective tariff duties, which fail to yield desired results in the case of commodities of which we produce export surpluses—that is, to establish a higher level of farm prices here behind the tariff wall.

The price-raising mechanism, however, is different under the debenture plan. It seeks to achieve its end by a somewhat roundabout process—essentially by offering a premium or bounty on exports of the commodities in question, in the confident expectation that farmers will be enabled to sell the whole of their marketed crop at prices higher than would otherwise obtain, practically to the extent of the export premium.

For the purpose in hand it is unnecessary to trace the evolution of the proposal from its first suggestion through the form that it has taken in various bills. It will suffice to summarize its essential features, with special attention to its maturer form in the latest bills.

PRINCIPAL FEATURES OF THE PLAN

For various reasons—constitutional, administrative, and psychological—an outright cash bounty is avoided.[1] Exporters of debenturable products would be entitled to receive from the Treasury, on due proof that the export commodity had been produced in the United States and had not been previously exported therefrom, bearer certificates called export debentures.[2] Each of these would represent a sum determined by the debenture rate and the quantity exported. The debentures would be receivable at their face value, within a year from the date of issue, in payment of customs duties. The expectation is that demands from importers would create a market for these debentures in which they would sell at

[1] Cf. C. L. Stewart's views in Senate Committee on Agriculture, *Agriculture Relief Hearings,* March 31, 1926, Part 1, pp. 43, 44, 78; House Committee on Agriculture, *Agricultural Relief (Export Debenture Plan) Hearings,* February 10, 1928, Serial E—Part 5, pp. 368–69; *Journal of Farm Economics,* January 1928, X, 29.

[2] The term "debenture" has long been applied to a customhouse certificate given to an importer indicating that he is entitled to a drawback. The term was applied to customhouse certificates issued to grain exporters entitled to bounties under the earliest English corn bounty legislation.

only such a nominal discount as would induce importers to use them instead of cash for payment of import duties.

The numerous earlier bills provided for applying the debenture plan forthwith to a specified list of debenturable commodities, including practically all the farm products of which the United States produces an export surplus, as well as manufactures thereof. Wheat and flour were naturally specified in each bill. Under the debenture provisions of the recent McNary bill, the plan was to be applied by the federal farm board, when necessary to attain the stated objects of the bill, to particular farm products and *food* manufactures thereof. The discussion of the plan in general would be affected by its scope, and that might be quite different in the semi-optional form most recently proposed from what it would be under the more comprehensive plan embodied in earlier bills. As applied to wheat, however, the distinction is of secondary importance, except as it concerns the date on which the plan might be put into effect.

The McKinley-Adkins bills fixed the debenture rates generally at the level of existing tariff duties, except for a rate of 5 cents a pound on cotton, which is on the free list. Chiefly in order to improve the prospects of passage, later bills specified normal debenture rates approximately equal to one-half existing tariff rates, except for a rate of 2 cents a pound on cotton and a single rate on tobacco. But provisions for alterations in rates by administrative action were incorporated in the bills, and the proponents of the plan plainly regarded the initial rates as in no sense definitive or final. The McNary bill designated no specific rates, but required the Secretary of the Treasury to name particular rates in accordance with the following provision:

> *d*) Debenture rates in effect at any time with respect to any agricultural commodity shall be one-half the rate of duty in effect at such time with respect to imports of such commodity, except that so long as no import duty is imposed on cotton the debenture rate thereon shall be 2 cents per pound. The debenture rate in effect at any time with respect to any manufactured food product of any agricultural commodity shall be an amount sufficient, as nearly as may be, to equal the debenture that would be issuable upon the exportation of the quantity of the agricultural commodity consumed in the manufacture of the exported manufactured food product, as prescribed and promulgated from time to time by the board.

Thus, under existing tariffs, the debenture rate on wheat would be 21 cents a bushel, and that on flour not 52 cents per 100 lbs. (which is one-half the duty on flour), but probably around 48 cents. The several 1928 bills particularly made provision for reductions of debenture rates that should be made, either in accordance with a stated schedule or at the discretion of the administering board, in the event of increases in acreage or production beyond stated limits. The Norris amendment to the McNary bill added such a provision, with a scale of reductions copied from the Ketcham bill of February 6, 1928 (H.R. 10568).[1]

While the rates would thus be subject to alteration, by administrative action, by Congressional amendment of the enacting law, or by changes in tariff duties, the system once adopted would presumably be as permanent as the tariff system. In no form has the plan been presented as an emergency measure of limited duration. The McNary bill, while it charged the federal farm board with the duty of applying the scheme under stated conditions, did not empower the board to remove a commodity from the debenturable list or even to reduce the rates except in accordance with the scale set forth. Most of the earlier bills went no farther in these respects. President Hoover, in his ten-point analysis of the latest form of the proposal,[2] virtually prophesied that if it were adopted in optional form, it would soon come to be comprehensively applied. He said in his fifth point:

> Although it is proposed that the plan should only be installed at the discretion of the farm board, yet the tendency of all boards is to use the whole of their authority and more certainly in this case in view of the pressure from those who would not understand its possibility of harm and emphatically from the interested dealers in the commodity.

[1] See discussion below, pp. 326–29.

[2] *Congressional Record,* April 22, 1929, p. 284. In this study all references to the *Congressional Record* are to the original issues. In the bound volumes the paging is somewhat altered.

Conceivably this would prove to be true. Certainly, if once applied to a commodity, the forces tending to prevent its abandonment would be much stronger than those leading to its application, and nearly as strong as the forces which tend to prevent removal of protective tariffs. And it may be assumed that the tendency would similarly be to raise rates rather than to lower them. Probably only definitely convincing demonstration of failure or disadvantageous net consequences would lead to abandonment after trial. Though the plan may be regarded as experimental, it is not a simple experiment that can be tried and dropped at will. The very trial would create conditions which would make continuance easier and suspension or elimination difficult.

Some advocates of the plan, notably Mr. L. J. Taber, Master of the National Grange, have argued that the plan is self-eliminating.[1] But the term is inappropriate and misleading. The argument is merely that if, as, and when we cease to be exporters of a debenturable product, as it is anticipated will occur in pursuance of long-time trends, the plan will become inoperative with respect to that product. Assuming this to be true, the obsolescence of a debenture rate would be caused not by the working of the plan, but by broad economic forces. By putting a premium on exporting these products, the debenture plan itself would tend in the opposite direction, not to accelerate but to retard the decline in export surpluses. So far as the plan exerts an influence, it will be self-perpetuating, not self-eliminating.

In short, the export debenture plan must be regarded as a proposal for a permanent complement to our tariff system, an enduring element in a newly-oriented agricultural policy. It would be permanent, not in the sense that it would be unalterable or inevitably of indefinite duration, but in the sense that there is no natural point of termination and that forces making for persistence will be set up by the adoption of the plan itself.

[1] House Committee on Agriculture, *Agricultural Relief Hearings*, January 10, 1927, Serial U—Part 4, pp. 135–36, 138, and February 14, 1928, Serial E—Part 5, p. 417.

[2] See, for example, the National Grange leaflet, *The Export Debenture Plan*, published in 1928; and C. L. Stewart's memoranda in Senate Committee, *Agriculture Relief Hearings*, April 1, 1926, pp. 73–76.

The Case for the Plan

In the course of a few years the proponents of the debenture plan have elaborated in its behalf a well-knit series of arguments. Some of these are essentially defensive, calculated to meet criticism or to show that it is not subject to criticisms leveled against other major proposals. Some are designed merely to lend it prestige, or to make it appear a highly logical and simple step. Some are definitely constructive. In character and form many of the arguments bear the marks of having been wrought out in the struggle to substitute the debenture plan for the equalization fee plan, or to win the support of devoted adherents of the protective tariff. A broad summary of the case for the plan,[2] with special emphasis upon the constructive arguments, is a natural preliminary to an analysis of its probable operation with wheat.

The defensive arguments run somewhat as follows: The plan is no radical innovation; rather it is in line with approved public policies of long standing—notably the protective tariff and the drawback system. No more than these would it involve a subsidy or tend to provoke reprisals abroad. Its costs to the Treasury and the public would be essentially of the same character as the costs imposed by protective tariffs, and would be fully justified by the stimulus given to national prosperity. It would not threaten the tariff system, but rather strengthen its position. It would involve no special taxation of the farmer. It avoids price fixing, would not foster monopoly, would not put the government into business. Food costs need not be increased appreciably, if at all, by the plan in operation. It would not interfere with business. It would neither restrict co-operation by farmers nor make co-operation compulsory. Tendencies to overstimulate production would be held in check. It would be "consistent with the dignity and independence of the farmer," and "humiliating to none of the leaders in the present discussion of the farm surplus problem."

Of the basic arguments the first is that of justice. As matters now stand, it is argued, the farmers bear a large part of the burdens imposed by our national policies embodied in protective tariffs, immigration restriction, regulation of railroad and other public utility rates to ensure so-called "fair returns" on capital invested, and the like; but they reap little real benefit from these policies and enjoy no comparable benefits from public action. "Equality for agriculture," between farmers and industrial and commercial classes, requires that agriculture be given, not a mere nominal protection through tariff duties that are virtually inoperative on export crops, but a genuine opportunity to raise itself to the same high price level. Equity demands that the tariff be made effective in raising prices of farm products, unless the whole protective system is to be built down. To quote the Grange pamphlet:

> Equality between agriculture and the industrial and commercial groups could be restored either by pulling down the artificial high-price structure made possible for these latter groups through such legislative devices as protective tariffs, immigration restriction, railroad rate legislation, exclusive patents and tariff rebates, or the readjustment could be made by enabling agriculture to take advantage of similar devices to raise itself to this same price level and thus meet the difference in costs of production here and abroad. The Grange prefers the latter—the constructive method — rather than the destructive and disruptive method.

It is further urged that the debenture plan is the appropriate method to employ to this end. To quote the Grange again: "Since the inequalities resulting from the tariff system are the chief source of difficulty, the logical and sensible thing is to apply the remedy at that point." The plan is a natural complement to the protective tariff. According to sponsors of the proposal, it was so recognized by Alexander Hamilton, the father of our protective tariff,[1] and is so recognized by many nations today.

Furthermore, it is represented that the plan would be exceedingly simple to operate, notably simpler than most plans that have been proposed. Its administration would require no large, new, complicated machinery, and only inconsiderable expenditures.

Most important of all the contentions, the plan would work. Promptly and surely it would raise farm prices of the entire marketed crop of a debenturable product by almost the full extent of the debenture rate. It would hold prices up, until we cease to be exporters of such a product, when the tariff duties would become effective in the usual way. Considerable foreign experience with similar devices, it is asserted, fully bears out the reasoning as to the effectiveness of the plan.

The final step in this chain of reasoning is that such price elevation will put the great bulk of American farming on a remunerative basis,[2] not as a single panacea, but as one essential in conjunction with increased tariffs on farm products, changes in land policy, and other desired measures.

"Inexpensive, simple and effective," according to the Grange, "it will adapt tariff benefits to the farmer's needs and will strengthen our entire economic and governmental structure. It will build up prosperity for the farmer and disturb that of no other group."

We do not propose to discuss the validity

[1] For a critical analysis of this argument, see J. S. Davis, "The Export Debenture Plan for Aid to Agriculture," *Quarterly Journal of Economics*, February 1929, XLIII, 258–63. The summary is as follows:

"The similarities between Hamilton's proposals and the debenture plan are three: Hamilton endorsed the principle of bounties; he favored the application of this principle, to a limited extent, to agricultural products; and he contemplated that bounties should be covered out of tariff revenues. Alongside these superficial resemblances, the contrasts are striking and fundamental. Hamilton's limited commendations of bounties on agricultural products related chiefly to bounties on production—not on export; they were designed to stimulate the production of a 'new object of agriculture,' of which we produced too little to supply manufacturers with sufficient raw material of satisfactory quality at moderate price; and he sought to cheapen these materials, not to make them dearer. The export debenture plan, on the other hand, relates solely to export bounties; it concerns the export of 'old objects of agriculture,' of which we already produce a more or less substantial export surplus; and it seeks to raise the price without stimulating the production."

[2] The efficacy of such price advance in restoring prosperity to farmers has not been elaborately argued. Some ardent supporters of vigorous measures of farm relief, including Senator Brookhart and Congressman Haugen, have been unable to see that the debenture plan would contribute more than a fraction of the additional billions that they consider American farmers must have in order to attain normal prosperity and secure their fair share of the national income. See, for example, Mr. Haugen's speech in *Congressional Record*, May 1, 1929, pp. 758–59.

of these numerous arguments, nor to set over against them the counter-arguments that have been brought forward. Several will be touched upon incidentally, some briefly in conclusion, others not at all. We shall not here discuss the broad questions of the justification for direct price-raising measures of any sort, and the extent of price enhancement to be sought. But certain basic arguments for the debenture plan call for careful examination at some length here, with primary reference to its prospective operation with wheat and flour.

The crucial argument in the whole chain is that the plan will really work, promptly, certainly, and continuously, to raise and sustain farm prices of the debenturable products by something approximating the amount of the debenture rates. In comparison with this, even the other constructive points are of secondary importance. If this can be convincingly established, the argument is more than half won; if it is gravely weakened, the whole case tends to crumble. This subject requires consideration commodity by commodity; and wheat furnishes an excellent example, though it cannot be called typical because each commodity presents peculiarities of its own.

Proponents' Theory as to Price Effects

The price effects of the plan have seemed to its sponsors too nearly obvious to require much elucidation or argument. They have not carried the exposition very far because the point seemed to them almost axiomatic. Until recently, at least, their theory has not been very seriously challenged, and even the recent criticisms have appeared not to shake firmly-held convictions or to require extensive strengthening of the case. We must therefore preface the analysis by setting forth, with some care, the theory as the proponents hold it, quoting especially certain passages in which wheat figures as an illustration.

Under the plan, as we have seen, exporters of debenturable products can count upon receiving export debentures with a face value representing the debenture rate multiplied by the number of units exported. These debentures they can sell to importers, who can use them at their face value in payment of customs duties. If, as is contemplated, the total debentures issued are considerably less than requirements for customs duties, importers will presumably pay the face value less a slight discount sufficient to offset the expense and inconvenience involved in using them instead of cash. Exporters, assured of such a "premium" on exportation, can thus afford to bid higher for the goods to export. The theory is that exporters, competing for the opportunity to export debenturable goods and so to obtain the debentures, will bid up the domestic prices of these commodities by almost the full amount of the debenture rates; that similar competition in the earlier stages of the marketing process will result in passing this increase back to the farmer seller; and that the resulting enhancement of prices will affect not merely the exported fraction but the entire domestic crop.

The advocates of the debenture plan seem to entertain not the slightest doubt that such price elevation would be realized. Says the Grange in its supporting pamphlet:

> ....Naturally the effect of such an arrangement would be to raise immediately by approximately the amount of the export debenture, the prices of these farm products now held down to the foreign level. This would follow because any holder of these products could readily sell his supply in the foreign market at the foreign price and get in addition thereto the value of the export debenture or certificate. He would therefore be able and willing to pay a higher price, and the general price level for these crops in this country would ascend rapidly by approximately the amount of the export debenture.

Professor Stewart, in an early statement before the Senate Committee, gave an example with wheat:[1]

> A debenture rate of 10 cents a bushel on wheat would enable exporters and jobbers to bid for wheat not merely the amount which world-market quotations would permit, after deducting for costs, insurance, and freight to foreign markets, but 10 cents more. If the wheat rate were 20 cents a bushel the bid price in interior American points would be that amount above the price otherwise sure to prevail. As a result, the plan would effect a like increase in the price of wheat actually

[1] *Agriculture Relief Hearings,* March 31, 1926, p. 44. In a supplementary memorandum (*ibid,* p. 76), he recognized the qualification, discussed in our text below (p. 316), that the price enhancement would not affect all types and grades equally.

shipped abroad and in the price of all other wheat in interior American markets.

He said further in the same testimony:[1]

. . . . when an export bounty is paid the exporters are able to compete, bidding prices as much higher than the world market quotations would otherwise permit as the amount of the bounty would indicate, and through their competition with the millers and other purchasers and handlers within the country the higher price is affected not only in the case of that portion of the crop which actually goes abroad, but that the same higher price is effected with reference to the total crop.

In later testimony before the House Committee, Professor Stewart quoted, from "a report laid before a House Committee 30 years ago," the answers of Mr. George F. Stone, Secretary of the Chicago Board of Trade, to questions put by David Lubin.[2]

Mr. Stone, I desire to ask you a few questions in your official capacity as secretary of the Board of Trade of the City of Chicago.

What effect would a Government bounty on the exports of wheat have with respect of the general price of wh[e]at throughout the United States?

Answer. I[t] would in my opinion increase the price per bushel.

Question. It is said that the speculators would get the 5 cents bounty, or at least the greater part of the bounty.

Answer. If a bounty of 5 cents a bushel should be given by the Government on all wheat exported from this country, in my opinion the farmer or producer would receive the full benefit of that bounty and not the speculator or exporter. It would simply enable the buyer to pay that much more than he otherwise could pay or would be justified in paying. Competition would force him to pay all he could to the farmer to obtain his wheat. It would be for the interest of the exporter to obtain the wheat; that would be his object. Competition would force him to secure it by every possible means without loss to himself. His great object is to maintain his business, to enlarge his business. Competition would impel him as it now impels him to give every cent that he can possibly afford to secure the product which he seeks to export. The fierceness and intensity and volume of competition, by the very force of circumstances, by the very necessities of the case would drive the 5 cents bounty proposed by the Government into the pockets of the farmer or producer. There it would land and from there it could never be wrested by speculators or by anybody else.

Question. It is also admitted by some that the 5 cents would come in some way to the producer for the quantity that would be exported, but that there would be no advance on the greater quantity remaining for home use.

Answer. It is a mistake, in my opinion, to say that the 5 cents per bushel bounty which it is proposed to give would be confined in its beneficial results to the quantity or volume of grain exported. It would affect the price of the entire crop, for the reason that grain is a surplus crop in this country, and consequently the price per bushel of this grain is fixed and controlled by the export price of this grain, and this export price, of course, I will here say parenthetically, is made in competition with all the other surplus wheat-producing countries in the world. No domestic buyer will pay one single fraction of a cent more for a single bushel of wheat than the buyer for export will pay. The latter makes the price for the entire crop. If no more were raised than was required for home consumption the price would depend upon the domestic demand; but the export demand is a continuous demand, inasmuch as the demand for food can never be interrupted for any length of time, and this continuous demand for wheat, so far as a surplus wheat-producing country is concerned, fixes the price of the entire crop of this cereal of that country. No class of domestic buyers, of course, can be made to pay any more than the price offered by the export demand, the domestic and the export demand being ever present in the market.

The argument has not been so elaborated with respect to other commodities, but the clear implication has been that what would hold for wheat would hold for others on the debenturable list. The minority report of the House Committee on Agriculture on the Agricultural Surplus Control Bill, submitted by Mr. Ketcham on April 11, 1928, supported the debenture plan as "an extremely simple device which all admit would work and work quickly and positively. . . . . It would automatically lift the domestic price and aid the producer of farm products practically to the amount of the debenture." Mr. Taber said before the House Committee on February 8, 1928:

There has been no complaint anywhere, no charge made by anyone that the export debenture idea would not raise price levels. It brings the farmer under the protective system, whether tobacco or wheat, to the extent of the amount of the debenture, and raises general farm price levels. No one denies this.

As the foregoing quotations show, the emphasis has been laid on the *price-raising* effects, not on the *price-upholding* effects.

[1] *Ibid.*, p. 47.

[2] *Agricultural Relief (Export Debenture Plan) Hearings,* February 10, 1928, Serial E—Part 5, p. 361.

It is commonly implied that if prices are raised, they will stay up—not necessarily at the same level, for the levels of domestic and foreign prices would both be affected by variations in crops and demand, but on levels higher than they otherwise would be, by the amount of the debenture rate. The possibility that production might be stimulated is recognized, though clearly not taken very seriously by the advocates of the proposal; but this has been generally regarded as a kind of special problem, to be dealt with by reductions in rates if and as production should increase. It has not been generally viewed by the proponents as a possibility that might seriously limit the realization of price advantages.

Method of Analysis

In analyzing the theory one must rely mainly upon reasoning in the light of available facts, rather than upon demonstration and proof. No one can predict with certainty and in detail how the plan would actually work. We are forced to consider reasonable probabilities. In so far as our conclusions or inferences differ from those of the supporters of the plan, they must be judged on the relative merits of the reasoning, and on the reliability, adequacy, and pertinence of the facts employed.

As a matter of fact, even if the plan were tried out and a retrospective examination of its working were made, the conclusions would have to rest in considerable measure on the same sort of reasoning process. Certain predictions would be confirmed or refuted by experience; but crucial questions as to price effects and others could not be definitively answered in full by statistical or non-statistical data. The actual movements of prices, of acreage, of production, here and abroad, could be set forth; but it would prove impossible to ascribe to the debenture plan the true extent of its influence among the many factors at work. This has been the experience in attempts at interpretation of the effects of protective tariffs. Throughout the eighteenth century, when England had in force a system of export bounties on grain, a controversy raged over the effects of this system on prices, production, and trade, on the landed interests and the consuming public. Economists and economic historians have not yet agreed in their interpretation on these points.[1] Whether or not the debenture plan is given a trial, we shall never be able to answer with assurance all the manifold questions regarding its actual working. In attempting, therefore, to foresee how it would work, we are at a less disadvantage than might appear at first sight as compared with analysts after the fact.

For convenience and clarity, we shall divide our analysis into four main parts. First we shall consider the probable operation of the plan on the assumption that production is not stimulated by it, and that foreign countries maintain an indifferent or benevolent attitude. Second, we shall take up the possibilities of stimulus to production, and their secondary consequences, again assuming no resistance or retaliation abroad. Third, we shall examine the bearing of foreign experience with similar devices. Fourth, we shall discuss the possible and probable reactions of foreign governments.

II. REFLECTION BACK TO FARM PRICES

At the outset, let us inquire how the plan can be expected to work if we ignore the possibilities of expanded production and reprisals abroad. How fully would the debenture rates be reflected back to farm prices? To what extent would farm prices of debenturable products be raised, uniformly and generally, or on the average, above what they would have been in the absence of the plan? A number of points of varying significance call for examination in this connection.

The Extent of the Discount

An obvious but seemingly minor question concerns the extent of the discount on the debentures. To the amount of this discount at least, it is recognized that the growers could not reap the full benefit of the debenture rate. They could hope at best to gain no more than the net advantage gained by exporters, and this advantage would be

[1] See below, pp. 333–34.

no greater than the cash value exporters obtained from the sale of the debentures.

In his letter of April 19, 1929, to Senator McNary,[1] sent at the request of the President after the Senate Committee had solicited the President's opinion, Secretary Mellon said on this point:

> . . . . The debentures must inevitably sell at a discount if for no other reason than that they involve a certain inconvenience and will entail a considerable cost in handling and marketing, and since they do not bear interest must inevitably be charged with the cost of carrying them until presentation at a customs house. Ultimately most of them will find their way to New York, where approximately half of our customs receipts are paid, and presumably they will be dealt in there at quotations which may vary widely depending on the amount of debentures issued and the demand therefor, seasonal and otherwise. Machinery will have to be set up for transferring debentures from Galveston, let us say, to New York and for their sale there, which will necessarily involve banking and brokerage charges.

The advocates of the plan readily admit this, and assume that the discount might run as high as 2 or 3 per cent.[2]

Secretary Mellon, however, went on to say:

> If issued in large amounts, as they may well be, it is likely that the debentures will sell at a very considerable discount, which would not only deprive the farmer of a portion of the benefit arising from the debenture rate but represent a bonus to importers and would seriously dislocate the tariff schedules fixed by the Congress. It is not apparent, even admitting the desirability of paying an export bounty, why machinery should be set up the effect of which might be to permit the importation of, let us say, butter from Denmark or wool from Australia at rates lower than those established by law. Such a method of reducing tariff rates would unquestionably injure some American farmers in order to benefit other farmers, ...[3]

Clearly the discount might reach substantial proportions if the total issue of debentures should run above the customs receipts. Indeed, the discount might be much more than nominal if the issue ran above customs receipts only in particular months or seasons, or if it merely approached the volume of customs receipts. The authors of the debenture plan have recognized this danger and have been concerned to guard against the occurrence of this eventuality. It was one of the reasons for setting debenture rates initially at approximately half the tariff rates instead of equal to the tariff rates. It was largely responsible for provisions inserted in the Ketcham bill of February 6, 1928 (H.R. 10568) and in certain other debenture bills whereby rates could be lowered if the total issue promised to exceed 50 per cent of customs receipts in a given year, instead of 100 per cent as in the McKinley-Adkins bills; and for the provision in the earlier Jones bills setting the limit at 40 per cent of the customs receipts, and restricting the use of debentures tenderable on any one imported article to 40 per cent of the duty.[4] It has led to calculations of the volume of debentures that would be required, at the rates commonly mentioned, in comparison with customs receipts.[5]

If the plan were applied to only one, two, or a few commodities, at the rates indicated by the recent bills, there is no basis for a fear that the discount would be substantial. Even if the measure were applied, at one-half the tariff rates, as comprehensively as proposed in the bills of 1926 to 1928, the probability of overissue would be slight at least for some time. On the basis of actual exports of the debenturable products, over a three- or five-year period, it has been calculated that the face value of the debentures issued would average around $150,000,000 a year, or well under 30 per cent of the average customs receipts.[6] If it reached

[1] *Congressional Record,* April 22, 1929, pp. 284–85.

[2] See C. L. Stewart's testimony, in Senate Committee on Agriculture and Forestry, *Agriculture Relief Hearings,* March 31, 1926, Part 1, p. 52.

[3] The rest of the sentence, which is not germane to the present discussion, is as follows: "whereas if a cash bounty were paid the latter would get the full benefit and there would be no dislocation of tariff schedules such as might prove injurious to our present manufacturing prosperity, which is an important factor in supporting the farmers' domestic market."

[4] The latter provisions would increase the probability that discounts would frequently become more than nominal, and aggravate the danger of the emergence of large discounts; for discounts would increase when the current issue of debentures approached 40 per cent, instead of 100 per cent, of current receipts from customs duties.

[5] C. L. Stewart's testimony in House Committee on Agriculture, *Agricultural Relief (Export Debenture Plan) Hearings,* February 10, 1928, Serial E—Part 5, pp. 366–68.

[6] Cf. L. J. Taber's testimony in *ibid.,* February 8, 1928, p. 314; and recent calculations of the Departments of Agriculture and Commerce, in *Congressional Record,* April 22, 1929, pp. 286–87.

an average figure of $200,000,000 a year, suggested by President Hoover, there would still be a large margin even in years of large exports and low imports of dutiable goods, and probably in all seasons of the year.

Nevertheless, the possibility of considerable or heavy discounts would have to be reckoned with if the plan were generally applied. The number of debenturable products might be enlarged. Exports of these products would almost certainly be stimulated, and in individual years might reach very large aggregates. Debenture rates might well be raised above the levels initially provided for. It is quite probable that if rates were set equal to existing tariff rates, in the effort to make the tariff fully effective for farmers producing the whole group of debenturable products, the discount might come to be substantial. Revenues from import duties may conceivably decline, at least in certain years. It requires no great stretch of imagination to envisage a season or a year in which, under such circumstances, debenture issues might be so large as to cause the debentures to fall to substantial discounts.[1]

However, we question whether this difficulty would be experienced. The prospect of such a development would almost certainly lead to reductions in rates or to special appropriations in advance of its occurrence. So great a reduction in net customs receipts as it would imply would attract widespread comment and criticism. On the whole, we think it reasonable to anticipate that the plan would not be applied in such a way as to permit discounts on the debentures to become heavy, or even considerable. More probably, it would be applied so that exporters would realize in cash nearly the face value of the debentures. If this were true, Secretary Mellon's point about the bonus to importers, leading to an effective reduction in tariff rates, would not appear of practical moment, logical though it is.

It should be noted, however, that to keep discounts within narrow limits (as well as to hold down the burden to the Treasury) implies restraints upon the extension of the debenture system, as to scope and rates. If exports should expand notably under the stimulus afforded by rates initially established, some contraction of the system might be called for, in scope, rates, or both. Moreover, if reductions in rates were made in an effort to avert the contingency, these might come at a time when they would be serious for farmers and middlemen alike.

It is a much more complex matter to determine how fully the discounted value of the debenture would be reflected back to farmers, even apart from the possibilities of stimulated production and foreign retaliation.

Bonus to Speculators and Others

Even assuming an immediate effect on terminal prices, to the full extent of the discounted debentures, the initial benefits of the price advance would accrue by no means wholly to the growers. President Hoover said in his letter of April 20, 1929, to Senator McNary:

> 2. The first result of the plan, if put into operation, would be a gigantic gift from the Government and the public to the dealers and manufacturers and speculators in these commodities. For instance, in the principal export commodities the value of the present volume of stocks in possession of these trades would, if the plan worked, rise by from $200,000,000 to $400,000,000, according to different calculations, without a cent return to the farmer or consumer. Every speculator for a rise in our public markets would receive enormous profits. . . . .[2]

This point had apparently been overlooked in earlier discussions of the plan. Its force is not diminished by the rejoinder that precisely the same thing happens when protective tariff duties are raised or imposed anew.

Considering the point with reference to wheat and flour, it is difficult to appraise accurately the amount of the "bonus" that would accrue to non-farmer interests. If prices of the various wheats were raised over night by the amount of the debenture rate, the gain to others than farmers would

[1] Because seasonal variations in exports are not synchronized with seasonal variations in dutiable imports, seasonal discounts might arise, for example, in the summer and early autumn; but these would be of limited dimensions so long as average customs duties exceeded average debenture issues by a comfortable margin.

[2] *Congressional Record*, April 22, 1929, p. 284. See below, p. 311, for the rest of the quotation.

be, under the present proposal, 21 cents a bushel on all the wheat (grain or flour) in the country outside of farmers' hands. The total might lie anywhere between 16 and, say, 100 million dollars, depending on the volume of commercial stocks at the time. The calculation is complicated by the fact that prices would rise well in advance of the actual application of the debenture as the market anticipated and discounted the application. The advance would be spread irregularly over a period of several months. The gain to others than farmers would be based on average commercial stocks over a period; it would be greater than the minimum stated above and less than the maximum. If the debenture were subsequently reduced or abandoned, there would similarly be a loss to non-farmer interests.

It is important to note that the gain by others than farmers on application or increase of a debenture rate, and the loss on reduction or abandonment, would not in practice comprehensively affect mills, elevators, and other handlers of cash wheat. In most regions these uniformly hedge their stocks of wheat (and advance sales of flour), and are little affected by such general wheat price changes. The gains and losses would accrue chiefly to speculators in wheat futures. The net gain to speculators from the application of the debenture, which may be estimated as likely to be in the neighborhood of 40 or 50 million dollars from a 21-cent rate, would be at the expense of the Treasury and consumers. Because it would be spread over a period, owing to the discounting of the expected price advance, not much could be done to control the amount by applying the debenture at a time when stocks were low. The net loss to speculators, when the debenture rate was lowered or removed, would be balanced by a gain on the part of farmers who had sold their wheat at higher prices than the event justified.

The case would be different with various commodities. In this respect cotton would be most nearly similar to wheat; but even for cotton, hedging is less general and less effective than for wheat and flour. With several commodities exchange trading is not practiced. At best, farmers would not get the full benefit of the Treasury cost at the outset, and in case of increases in rates; but this would be only a passing phase.

Increased Risks

As part of his sixth point against the debenture plan, President Hoover averred that "increased risks would absorb a considerable part of its effect. . . ."[1] In completing his second point he said:

> . . . Conversely, if, after this elevation of prices, the plan were at any time for any reason withdrawn the trades would suffer a like loss and a long line of bankruptcies must ensue. But in the meantime the trades, out of fear of withdrawal or of reduction in the subsidy, would not engage in normal purchase and distribution. Either exorbitant margins would be required or alternatively the farmer would be compelled to himself hold the Nation's stocks until there was a demand for actual consumption.

Obviously if the debenture system were certain to remain unchanged for a period of years, this objection would not hold. But no one could be sure of this. In the light of our subsequent analysis of probable benefits to the grower, the probabilities of expanded production, the possibilities of increased cost to the Treasury, and the risks of retaliation abroad, we feel that apprehensions as to discontinuance of the system might be considerable, if not from the outset at least within two or three years. The possibility of changes in rates, under a system of flexible rates or otherwise, would increase trading risks, and so require a sort of insurance premium charged by holders of commercial stocks.

This argument is valid for commodities in which hedging is not generally practiced, though we believe that President Hoover viewed with undue apprehension the consequences of such uncertainties as would exist; but it is less valid in the case of wheat. The net loss from the abolition of the scheme would fall mainly on speculators, as indicated above, and would not be large in relation to the losses commonly taken in the ordinary course of price fluctuations. The added risk from uncertainty as to the continuance of the debenture would be not unlike many risks upon which grain speculation thrives. In general it should not affect margins of dealers in wheat, and

[1] More fully quoted below, p. 312.

would probably not lead to any significant alteration in current practices as to holding or hedging stocks, on the part of farmers, grain dealers, or millers. We therefore question whether the wheat grower's benefit from the debenture system would be appreciably reduced in consequence of this risk factor.

Increase of Exports

Increased exports, even apart from expansion in production, would constitute a minor factor tending to reduce the net gain by farmers to less than the full extent of the debenture rate. The offer of the export bounty, and the raising of domestic prices, would tend to bring about some reduction in domestic consumption and some increase in exports. The increase in exports, indeed, might easily be larger, in the initial year, than the reduction in consumption, for stocks could usually be drawn down. The addition to exports would exert some downward influence on international wheat prices. Hence even if the system maintained a differential, almost equal to the debenture rate, between domestic and export prices, the level of export prices would be somewhat lowered, and the net advance in farm prices would be correspondingly reduced to a slight extent.

As Secretary Hyde said in his letter of April 20 to Senator McNary:[1] "In order to dispose of the surplus the exporter would have to make some price concessions to meet the competition from other countries and this would tend to depress world prices." Wheat exporters are concerned not merely with their margin of profit in particular transactions, but also with their volume of business; and they seek to secure the maximum net profit on their operations in the aggregate. If a premium were offered them to export American wheat, they would naturally seek to retain as much of this premium as possible and to handle a larger volume of this wheat; and they would probably be stimulated to seek out foreign markets for American wheat, particularly of types and grades that are cheapest here. In so far as they were able to increase their volume of export by offering the wheat cheaper than under present conditions, they would certainly tend to do so. The reasonable prospect is that they would succeed in enlarging their volume of exports only by so doing. Competing for additional wheat for export, they would doubtless tend to force up farm prices, but under such conditions, they could not afford to bid up the domestic price by the full extent of the debenture rate. They would be naturally indifferent, in a business sense, to the ulterior consequences of their operations on the farmer, and would make little or no attempt to gauge them.

The initial importance of this factor might be insignificant, but it would assume greater importance if and as production and exports should increase under the stimulus of higher prices. The increased volume of inferior wheats available for export would tend to lower their position in the range of wheat prices in foreign markets. How far this difficulty might be overcome by improved merchandising efforts, such as the Canadian wheat pool has made and as an export corporation would doubtless make, it is impossible to estimate.

Imperfect Competition

In the next place, it is rash to assume such perfect competition among exporters, and especially in earlier stages of the merchandising process, that the full amount of the sale value of debentures would be reflected back to farmers, even if there were no complications as to type, grade, quality, and location. Secretary Hyde said in his letter of April 20 to Senator McNary:

> . . . . Furthermore, it is possible that exporters may not bid prices up to the full extent of the debenture less the normal exchange discount on the certificate. It is therefore possible that exporters might be in a position to derive an extra profit by not reflecting in prices paid to farmers the real value of the debenture. . . . .

In his sixth point against the plan President Hoover said in part:[2]

> . . . . it seems certain that a large part of it would not be reflected back to the farmer. It offers opportunity for manipulation in the export market none of which would be of advantage to the farmer. The conditions of competitive marketing at home and abroad and the increased risks would absorb a considerable part of its effect into the distribution and manufacturing trades.

[1] *Congressional Record*, April 22, 1929, p. 286.
[2] *Ibid.*, p. 284.

Questions on this point have caused the authors of the plan some concern. In general they have answered that the Federal Trade Commission could be counted upon to help in correcting abuses of this sort that might arise; that co-operatives would develop their export business and help make competition effective; and that if need be export corporations might be set up in the farmers' interest to insure the full and fair operation of the reflection process.[1] Under the Ketcham and Jones bills of April 11, 1928 (H.R. 12892, 12893), export corporations were provided for. The co-operatives and stabilization corporations provided for by the recent Agricultural Marketing Act might be regarded as affording equivalent or better machinery. Action by such agencies might be called for, on this ground as well as on others (see below, p. 314).

No one can really appraise the possible extent to which, if at all, collusion or combination among exporters, or manipulation of domestic or export markets, or like efforts would limit the farmer's gains from the debenture system. In view of the growing tendency toward combination and the fact that most of our grain exports are now handled by only a few concerns, conditions would presumably not be unfavorable. Moreover, it would be difficult to detect many types of such practices, or to fix any "guilt" upon parties responsible for impeding or limiting the reflection of the debenture rate back to the grower. There are, under present marketing conditions, numerous complaints that wheat growers fail to get the full value of their product. That this is true in individual instances is not open to doubt, but that it is true on the average is difficult to say.

On the whole, we are disposed to regard this sort of possibility, like those mentioned above, as of minor importance, particularly as compared with possibilities lying within the limits of competitive operations. To discuss these requires some reference to current trade conditions.

[1] Cf. House Committee, *Agricultural Relief Hearings*, February 8, 1928, Serial E—Part 5, pp. 311–12 (Taber), 325 (Connally).

[2] Cf. T. D. Hammatt, *Methods of Merchandising American Wheat in the Export Trade* (U.S. Bureau of Foreign and Domestic Commerce Trade Information Bulletins 183 and 185), February 1924.

Phases of the Competitive Situation

Many proponents of the export debenture seem to picture wheat exporters as a considerable group of merchants carrying large stocks in trade, namely, export wheat, with a simple and direct relationship between the buying and the selling prices into which the figure for the export debenture may be inserted after a fashion quite as simple as a bookkeeping entry. The true picture of the circumstances involved in the export of wheat is quite different.[2] Wheat exporters in the United States do not constitute a large group of independent American merchants whose business is confined to the export of United States grain. The great bulk of the business is handled by a few concerns. Some are American concerns with foreign connections; others are American agents of European concerns. Very little export business is now handled by co-operatives, though under the new legislation this export volume handled by wheat co-operatives or the Wheat Stabilization Corporation will presumably grow. Most of the exporters handle Canadian wheat as well as American, and indeed usually find Canadian wheat representing the larger part of their volume. The business of exporting wheat involves intricate transactions of infinite detail. Wheat price relationships are never simple and persistent, and it is difficult to say when they are most complex—in a year of short world crop with rising prices, or in an ordinary year of relatively easy adjustment, or in a year of plenty when wheat-importing countries can pick and choose with great freedom.

The American wheat exporter is really a middleman, working on a self-set margin, with occasional reward for unusual shrewdness. To some extent, exporters carry stocks of wheat in readiness for export business, at least in certain advantageous positions. But for the most part, they purchase the wheat necessary to fill an export order subsequent to having accepted an offer from some foreign country. Since most export wheat is sold c.i.f. port of destination, when the American exporter accepts an offer he must know in what positions wheat is lying, for what the export grades may be purchased, and the momentary situation in ship space. In the customary transaction, the

exporter engages his ship space and then purchases his wheat from local intermediaries, commonly termed "fobbers," who expedite the wheat to the port of embarkation. The transactions down the line are protected by hedging. Probably there is more judgment displayed by the exporter in contracting for ship space than there is in contracting for wheat from fobbers; certainly, the handling of the shipping end is quite as important as the dealings in the buying end.

It is incorrect, moreover, to assume that there is a continuous and even merchandising of wheat, and a continuous and even absorption of wheat by mills upon which a continuous and even absorption of wheat by exporters would exert a continuous and even effect on price, approximating the figure of the debenture. The wheat market is not continuous but more or less seasonal and is, in addition, subject to irregular and wide fluctuations. There are times when the mills are buying wheat heavily, while at other times they are scarcely in the market. The period of heavy seasonal mill buying may coincide with heavy seasonal export buying, but need not. Only where the circumstances justify the use of the trade term "seller's market" does anything exist corresponding with continuous competition between mills and exporters. This is all the more true because, for the most part, the mills and the exporters are bidding on different grades of wheat, since in most years those wheats pass to export which are the culls of the crop. As a specific illustration, witness Duluth. From Duluth are exported the substandard spring wheats which have filtered, so to speak, through Minneapolis. One cannot picture the bidding of exporters for the wheat passing out of the Duluth gateway influencing in a consistent and even manner the purchasers in Minneapolis of the milling wheats from which the wheats available in Duluth have been rejected.

We are constrained to feel that an export board of some sort would be necessary to ensure the maximum possible reflection of the debenture rate back to the farmer. Competitive bidding of exporters would not be enough, except in years of world shortage, to drive up terminal prices by anything like the figure of the debenture rate. It would probably be necessary to have an agency with a revolving fund, able at any time to enter the market for the furtherance of the export movement. In the experiences of the United States Grain Corporation, it was necessary for the corporation to buy wheat, at times heavily, in order to maintain the guaranteed price. No action might be necessary in a particular year in respect to certain wheats; but in each year it would probably be necessary in respect to certain wheats, and in some years in respect to all wheats.

If export activities by a central agency were undertaken to promote the success of the system, the operation would presumably be attended by export losses on the part of such agency. There is, however, no provision in the export debenture plan for the disposition of such export losses. Thus, to make the plan effective, a procedure would be necessary which would occasion the emergence of a subsequent dilemma, for the solution of which the plan was not designed and makes no provision.

Effects of Diversity in Wheats

Thus far we have proceeded on the common assumption that wheat is wheat, and flour flour, without distinction of type, grade, quality, and source of production. But in fact our wheats are multifarious, of several types, many varieties, and numerous grades, produced in widespread agricultural regions, and commanding widely divergent prices at any given time. Flours too are of many types, classes, and grades. Not all debenturable commodities are correspondingly heterogeneous, but none is truly homogeneous. While this fact has not been altogether overlooked by spokesmen for the debenture plan,[1] its significance for the central theory has not been generally realized in connection with the plan.

In the case of wheat, for example, the United States produces several distinct types adapted to different uses. The chief types are hard red spring, durum, hard red winter, soft red winter, and (soft) Pacific white. Hard red spring and hard red winter are both primarily bread wheats, and

[1] Cf. Charles L. Stewart's testimony before the Senate Committee on Agriculture, March 31, April 1, 1926, pp. 53–54, 59–60, 76.

are broadly competitive, although geographical factors limit the effectiveness of this competition. Durum is used chiefly for making alimentary pastes, and soft red winter largely for pastry and biscuit flour; neither competes with the other or strongly with the bread wheats. Pacific wheats are used for bread or pastry flour, and would compete more extensively in domestic markets with soft and hard red winter (principally soft) if it were not for heavy costs of shipment eastward; as it is, little of this wheat goes east of the Rockies even when, as in 1925–26, 1927–28, and part of 1928–29, soft red winter commands high premiums, though flour made of Pacific wheat competes to some extent on the Atlantic seaboard. There is limited possibility of substitution between durum and hard bread wheats, or between hard wheats and soft wheats, although when large price differences among the groups occur, further adaptations either in manufacture of flour or uses of flour are made. The relation of crops to domestic requirements for these various types is such that the United States is nearly always on an export basis for durum and Pacific wheats, rarely so for hard red spring wheats, and more commonly for hard winter than for soft winter wheat.

Not only does our wheat crop comprise several different types that are (except for hard spring and hard winter) sufficiently distinct in uses or areas of production as to be either almost non-competing or competitive only under considerable disparity of prices; wheats of a single type grown in the same region vary in grade and quality so greatly that different lots command very different prices.[1] Within a single grade, on the same day, in a single market, the prices actually paid for different lots frequently vary over a surprisingly wide range.[2] Thus on October 3, 1928, 624 carloads of hard spring wheat were sold on the Minneapolis market. Carlot prices ranged from $0.95 a bushel, for a car of Northern Spring sold on sample, to $1.39 for one car of Hard Spring and one of No. 1 Dark Northern. Prices of different carloads of No. 1 Northern Spring, the commonest and the standard contract grade, ranged from $1.09 to $1.33, whereas the December future varied only between $1.131 and $1.142. Differences in protein content are the principal factor responsible for such variations, but there are many other factors. The relations between prices of different wheats within the wheat price range tend not only to vary from year to year with unchanged price level but also to be different at different price levels.

In practice, as a result of such conditions, our exports of wheat grain consist largely of durum and Pacific wheats, moderately low grades and qualities of hard red winter, and in certain years corresponding grades and qualities of soft red winter.[3] Nearly all of the hard red spring and practically all of the better grades and qualities of hard and soft red winter are retained for domestic milling, except in occasional years when crops are so large and good that domestic requirements for these types and qualities are easily satisfied and a surplus remains. Except in the case of durum and soft Pacific wheats, and not always for these, our exports of wheat grain are seldom if ever representative of the crop; they are characteristically much below the average of the crop, and still further below the fairly rigid standards for domestic consumption.

Our exports of flour ground from domestic wheats comprise three fairly distinct groups: limited amounts of high-grade flours ("patents"), from soft or from hard wheat, which go to foreign markets demanding a high quality product; medium-grade and common flours ("straights"), which result chiefly from the desire of domestic mills to keep costs down by high capacity operations; and low-grade flours ("clears"), which are essentially a by-product in the production of patent flours, and for which there is little domestic demand in relation to the supply.[4]

[1] Also, different varieties within the same type differ considerably.

[2] Cf. *Variations in Wheat Prices*, WHEAT STUDIES, June 1929, V, 246–52.

[3] The official statistics of wheat exports by classes and grades are not very satisfactory. See, however, WHEAT STUDIES, December 1928, V, 105, Table XXI; or *Yearbook of Agriculture, 1928*, p. 684, Table 18. Statistics of exports by customs districts yield useful supplementary information.

[4] On this paragraph see especially WHEAT STUDIES, March 1925, I, 126–31; and further below, pp. 319–21.

Our exportable surplus of wheat, then, is not a simple fraction of a homogeneous commodity that is produced in excess of domestic needs. It is much less nearly so than was the case before the war.[1] It consists in large measure, though by no means wholly, of particular types, grades, and qualities of wheat and flour that are not readily marketed here, and indeed often abroad, except at substantial discounts. To a considerable extent the surplus is qualitative as well as quantitative. Standards and practices vary so much that certain classes of wheat and flour are esteemed more highly here than in foreign markets, while others find a better market abroad than at home.

All this is familiar to millers, grain and flour merchants, many farmers, and all close students of the wheat situation; but it is largely unappreciated by many of those who have discussed the reform of our agricultural policy. The extent to which wheat is not simply wheat, not a single homogeneous commodity but a group of commodities, constitutes a fact of major importance in any discussion of the position of wheat growers and what can be done to improve their position. Something comparable is true of other farm commodities, such as cotton, tobacco, and corn, which figure prominently in the discussions. In the case of corn the problem is especially complicated by the fact that corn is predominantly a feed crop, and that the largest single fraction of the crop is used to feed hogs, from which a great variety of joint products are obtained.

The bearing of this can perhaps be made clear with reference to wheat as a debenturable commodity. The bills thus far presented prescribe a debenture rate for wheat, without distinction as to type, grade, or quality, just as the tariff rate is 42 cents a bushel on *wheat* of any kind.[2] If, now, a virtual bounty is offered to exporters of our wheat and flour, it will clearly stimulate them to bid higher for these commodities; but it does not follow that the bidding would be equally effective on prices of the various wheats. In the cases of durum and Pacific wheats, lower grades of hard bread wheats, and sometimes of lower grades of soft red winter—wheats that in any case would be moving into export—there is substantial reason to expect the higher prices to be largely reflected back to growers, subject to qualifications elsewhere mentioned. In years of a large crop of hard red winter, of good quality, the price-lifting influence would probably be most general and most pronounced, though premiums would probably then be low.

But in most years, as a result of conditions outlined above, some wheats command substantially higher prices for domestic use than for export. Even with the addition of a full 21 cents to the normal export bidding price, a large volume of these would in ordinary years be beyond the reach of exporters, so great is the premium offered for them in the domestic markets. Another part would be brought within the range of export possibility, as a result of the export bounty. The prices of high-premium wheats might conceivably be unaffected by the operation of the debenture plan. It is by no means certain that millers who buy high-grade wheats at premium prices would be forced to bid 21 cents more for these wheats simply because exporters were bidding 21 cents more for low-grade wheats. They might need to bid only a few cents more. Probably the prices of most contract and premium wheats would be raised to a certain degree, varying with the type, grade, and quality, in any one of several ways: for example, by direct bids which necessitated such increase in premiums as to keep them here; indirectly through raising the price and thus decreasing the economic substitutability of other types, grades, and qualities; or still more indirectly by causing contraction in the acreage and crops of such wheats in consequence of expansion of other types, as in

[1] Primarily for this reason, the opinion of Mr. George F. Stone (quoted above, p. 307), which may have been correct for conditions of the period when he spoke, would not hold good today.

[2] Professor Stewart recognizes the logic of establishing a series of different tariff and debenture rates for different types of wheat. See his testimony before the Senate Committee on Agriculture, March 31, April 1, 1926, pp. 53–54, 59–60, 76. No bill has attempted such a differentiation, and since the relationships among types, grades, and qualities vary considerably from year to year, it may be questioned whether such differentiation could be made flexible enough to serve the purpose. As to flour, see below, pp. 319–20.

the case of durum in the northwest. If expansion of production should take the course we anticipate, and the production of high-quality hard winter wheat be especially stimulated, premiums on hard red winter and hard red spring wheat might be materially reduced in consequence.

Reasoning on the facts as we see them, and in the light of trade experience, we can see no adequate justification for accepting the theory of uniform reflection of the debenture rate in farm prices, on these grounds alone. If the exportable surplus could be removed in a block, in the beginning of the season, this would stimulate competition between mills. But the exportable surplus does not appear in the beginning of the crop year; it is filtered out during the course of the crop year. If a treasury certificate enabled American exporters to bid up the price of contract-grade wheat 21 cents a bushel, at such times as it was expedient for foreigners to purchase wheat in this country, we see no reason to believe that domestic mills, selecting their stocks of wheat as successive harvests appear, would pay 21 cents more for the several premium wheats than would otherwise be the case. The wheats are not all placed on sale at once and the domestic and foreign buyers are not all there to take all the crop at once. The merchandising of a wheat crop is a highly selective process, and we cannot believe that any artificial device for changing the selling price of a subsidiary fraction of the crop will correspondingly affect the price of the entire crop.

A specific reservation deserves emphasis in respect of hard spring wheat. In years of usual crop characteristics, No. 3 Manitoba Northern has the same milling value in the United States as No. 1 Dark Northern. Often the c.i.f. price of duty-paid No. 3 Manitoba Northern wheat, at milling points such as Buffalo on the Great Lakes, is within 10 cents of the c.i.f. price of No. 1 Dark Northern. The advance in price of domestic hard spring wheat under the debenture system would be checked at the point of price parity, in milling values, of duty-paid Canadian wheat. To get from an export debenture any considerable increase in price of domestic hard spring wheat would necessitate raising the tariff above 42 cents.

The distribution of the advantages yielded by the system, and their secondary effects, also deserve attention. Clearly the wheat growers in the Pacific Northwest would tend to profit. The growers of durum in the interior northwest would also tend to benefit materially, while their neighbors growing hard red spring would presumably gain less; hence farmers in that region would tend to increase their durum acreage, to some extent shifting from hard red spring wheats to durum,[1] thus tending to increase our already growing exportable surplus of durum and our deficiency of high-grade bread wheats. Growers of soft wheat in the central west, where wheat farmers have apparently suffered much, would probably gain much less in many if not most years. Wheat growers in eastern deficiency regions, for various reasons, would probably be affected but moderately. Growers in the hard red winter-wheat belt would stand to gain relatively more in most years; since it is in this southwestern region that, for several reasons, acreage has tended most to expand rather than contract even in the face of prices generally regarded as unremunerative, further expansion in this area would be stimulated. The geographical distribution of the gains, therefore, would be far from uniform.

Apart from geographical considerations, the producers of less desirable wheats (as domestically appraised) would gain most, while the producers of premium wheats would gain least. Producers of export types would stand to gain most, and producers of deficiency types least—a result tending to increase the size of the export surplus, in both quantitative and qualitative senses. Such results can hardly be regarded as in the interests of agriculture or the national economy.

The Matter of Export Parity

It is commonly implied, in discussion of the problem of exportable surpluses, that we export routinely and that current prices in this country are continuously determined by or linked with prices in outstanding foreign markets. By export price

[1] Some such shifting has already been in evidence, in spite of the fact that in most recent years durum wheat has sold at prices considerably or heavily below those of bread wheats.

parity we mean that the price of wheat in Chicago and other markets, as of grade and quality, is no higher than the price of wheat in Liverpool when adjusted for transportation charges and other costs of movement. When the exportable wheats of Canada, the United States, Argentina, and Australia all stand at export parity, this means that the prices in the exporting countries and demand in Europe are so adjusted that a particular buyer in Europe can purchase in anyone of these countries on the basis of quality at relatively comparable prices. Of course, wheats cannot be exported routinely from any country if the price in that country is above export parity, i.e., out of line with the world market. Now despite the fact that we have been active exporters of wheat, it is surprising to note how frequently since the war, and how much of the time in the several different years, the contract prices of wheat in Minneapolis-Duluth, Chicago, St. Louis, and Kansas City have stood above export parity. Indeed, on several occasions the prices of wheat futures in Chicago have stood but little below those in Liverpool. Influences have been at work in this country tending to hold wheat futures high relative to other countries, which naturally has favored exports from other countries and not from the United States. The more effective the tariff, high domestic standards, and speculation are in elevating domestic prices of wheat, the more difficult it becomes to export such surplus as we possess.

One may further adjudge the times when our prices have been at or above export parity by reference to monthly statistics of wheat exports by customs districts. These data suggest, though they do not prove, that since 1921–22 hard and soft red winter wheats have been definitively upon an export basis throughout the whole crop year only in 1921–22, 1922–23, 1924–25, and 1926–27. They were not on an export basis throughout most months of 1923–24, 1925–26, 1927–28, and 1928–29; at least the wheat exports of all varieties of wheat except Pacific white and durum constituted a mere trickle in the last two-thirds of each of these years, even though there seems to have been plenty available for export in each of these years except 1925–26. Even without precise comparisons of price spreads between American and foreign markets, one is probably justified in assuming that United States prices of representative wheats were out of line with, say, Liverpool prices in most periods when exports were nil or negligible.

All this has an important bearing on the working of the debenture plan. The usual theory of the full reflection of the debenture rate in farm prices assumes that we are regularly on an export parity, for any and all wheats. This assumption, as we have seen, is contrary to the facts. In some years of relative domestic shortage of certain wheats, the domestic price may be above export parity through most of the crop year. But even in some years of relatively free export, domestic prices of certain wheats will be alternately above and below parity. The theory of the proponents further assumes that the effect of the debenture plan would be to raise domestic prices to a new export parity, 21 cents higher than the previous export parity. If this were true, the export debenture could do no more than raise our prices to the altered export parity. For illustration, let us assume that it costs 20 cents to move wheat from Chicago to Liverpool; if the Liverpool price is $1.50, then export parity price in Chicago must be $1.30. If, instead, Liverpool is $1.50 and Chicago $1.40, and an export debenture rate of 21 cents is established, the Chicago price could not be raised above $1.51, the new export parity; and the advantage from applying the debenture plan, so far as wheat of contract grade is concerned, would be only 11 cents, even neglecting an effect upon Liverpool prices.

Without wholly endorsing this calculation or the assumptions underlying it, we feel assured that the quantitative reflection of the export debenture back to producer would be different, if the domestic price were at or below export parity, than if it were materially above it, and would tend to be smaller whenever domestic prices would otherwise be out of line with prices in world import markets. In a year of extremely short domestic supplies, such as 1925–26, with practically no representative wheat available for export, domestic prices

would stand, through most of the year, above an export basis, with or without the debenture. It cannot be assumed, however, that in such a year, with the debenture in effect, prices would be as far above the new export parity as they would have been, in the absence of the system, above the old export parity. The debenture could not be expected to enhance domestic prices, in such a year, by anything like the same amount as in a year of active exporting. In such a year the tariff on wheat and flour would have its maximum effect in keeping up domestic prices; and even the proponents of the debenture plan do not expect its full influence to be superadded to such influence as the tariff already has.

What is true of such exceptional years as 1925–26 would be true of portions of other years, and indeed almost continuously with one or another type or grade of wheat. For these reasons alone, a varying but more or less substantial part of the promised advance in prices, as a result of applying the debenture scheme, would fail to eventuate.

The Case of Flour

The possibilities for imperfect reflection of price advantages back to the grower, under the debenture system, would seem to be larger in the case of joint products. Flour is a serviceable example. Its importance is suggested by the facts that the great bulk of our marketed wheat crop is milled in the United States, and that well over a third of our wheat exported in the past few years has gone abroad in the form of flour. The reflex action upon farm prices of wheat will necessarily depend heavily upon the bidding of millers, and this will be affected by the application of the system to flour exports. Despite their importance, there is no evidence that either proponents or critics of the debenture plan have given particular attention to flour or other joint products such as lard. We do not claim to have thought the matter through; but even cursory consideration reveals a complexity that is inconsistent with the reputed simplicity of the debenture plan, and suggests considerable possibilities for alterations in trade.

The miller has a raw material cost, somewhat modified by the outcome of his hedging account. He has expenses of manufacture, of management, and of selling. Broadly speaking, if he is making straight flour, he has one principal product, and one class of by-products collectively known as millfeed. As the miller views it, the millfeed is sold for what it will fetch, and the flour must be sold for enough to balance the account and leave a net profit. When the mill makes patent flour, an additional by-product appears, namely, clear flour. Clear flour—like millfeed—must be sold for what it will fetch; or, if the mill chooses to regard clear flour as a principal product, separate expenses and a joint expense must be set up for patent flour and clear flour. The actual situation is much more complicated than this, for there are many more than three homogeneous classes of flour and one of millfeed. A large part of the miller's problem consists in so buying his wheats, and so milling the wheats that he buys, as to yield, in the light of the cost of the wheats, his manufacturing and selling costs, and the price obtainable for his various products, the most profitable combination of flours and millfeeds.

This problem millers would face under the debenture system; but there would be modifications in the problem with respect to the domestic prices of American wheats, the relative costs of Canadian wheats for grinding in bond duty-free or for domestic flour use duty-paid, and the altered domestic prices of the various flours and millfeeds. There would also be the problem of the export debenture on flour.[1]

The tariff rate on flour (also "semolina, crushed or cracked wheat, and similar wheat products not specially provided for") is $1.04 per 100 pounds, representing a "compensatory" rate of 96.4 cents on the assumption that it takes 4.5 bushels of wheat to make a barrel of flour, plus an additional 7.6 cents as a protective supplement assumed to offset lower milling and marketing costs in Canada. In most of the earlier debenture bills, the debenture rate on flour was set at one-half the tariff rate, or 52 cents per 100 pounds. Under the McNary bill the Secretary of the Treasury would be charged with fixing the rate at

[1] Also the possibility of discriminating retaliation on flour, discussed below, p. 339.

"an amount sufficient, as nearly as may be, to equal the debenture that would be issuable upon the exportation of the quantity of the .... [wheat] consumed in the manufacture of the exported .... [flour], as prescribed and promulgated from time to time by the board."[1] The obvious aim is to have a schedule of compensatory rates, drawn up and altered from time to time in an endeavor to preserve their compensatory character.

The strict application of this provision would be far from easy. The actual amount of grain used to make the various kinds of flour varies considerably: it is highest in the best grades of patents, lower in straight flours, and still lower in semolina. For tariff purposes it has been thought impracticable to apply different rates to the several varieties and grades of flour, utilizing different quantities of wheat — straights, patents, cut straights, etc., by-product clears, and offals. Conceivably the debenture rates on flour would be not a single rate, but a schedule of rates. The administration of such a schedule would be troublesome and costly, and open doors to misrepresentation. Even such a schedule, however, could hardly accomplish its real purpose of keeping the flour rates equivalent to debenture rates on wheat, not merely because of the variety of types and classes of flour, but because milling ratios vary from crop to crop and otherwise. Since our present tariff on flour is virtually prohibitive, its simplicity is of no consequence; but the same would not be true of the debenture rate. The debenture rates and changes therein would interject a new factor into milling problems.

If, however, for reasons such as dictated single tariff rates on wheat and flour, and as has been commonly assumed prior to the recent McNary bill, a single debenture rate on flour were established, it might have notable effects on our flour exports. These now include a little patent flour, but mostly straights and clears, or mixtures. It would seem obvious that a single debenture rate, based on 4.7 bushels of wheat per barrel of flour,[2] would yield a special bounty on exports of clears and other low-grade flours, for a barrel of these represents much less than the equivalent of 4.7 bushels of wheat. On the other hand, the rate would not be sufficient to promote export of patent flours, for good patent flours require more than the equivalent of 4.7 bushels of wheat. It might be to the advantage of millers in some regions to export as much coarse flour as they could, utilizing the minimum quantity of wheat. The low-grade flours, of which the exports would be especially stimulated, have little appeal outside of Oriental, Levantine, and other low-grade markets. The export of more representative flours, patents and straights, would be discouraged. Similar unintended consequences have frequently flowed from the establishment of apparently simple tariff rates.

A related point should not be passed over. If, as no one has proposed, flour were a debenturable commodity but wheat were not, a marked stimulus to the export of flour would be given unless nullified by countervailing duties or their equivalent abroad. Also if, as no one has suggested, both wheat and flour were made debenturable, but the debenture rate on wheat were one-half the rate on flour, a considerable though lesser stimulus to flour export would be given. If our previous reasoning is correct, to the effect that somewhat less than the whole of the debenturable rate on wheat would be reflected back to the grower, somewhat the same situation might prevail. The debenture rate on flour would be more than compensatory, for this reason alone, and a portion of the flour debentures would represent an unintended and disguised, but no less real, bounty on flour exports.[3] This would tend to increase our flour exports, and the proportion of wheat exported in the form of flour, provided (and the proviso is important here) no countervailing measures were taken abroad.

We question how fully, under such circumstances, such special bounties on exports of flour, and particularly low-grade flours, would be reflected back to farm prices of wheat. It seems to us that the more indirect and roundabout the process through which the reflection must operate,

[1] See above, p. 303.

[2] This is approximately the average in current American milling experience. See WHEAT STUDIES, December 1927, IV, 92–98, 101.

[3] Cf. the indirect bounties on sugar exports discussed below, pp. 334–36.

the larger would be the prospect that part of the bounty would fail to reach the farmer.

Clearly the milling business and the export of flour would be greatly affected. Millers could doubtless adapt themselves to the debenture system, with its added complications, but they would seek to do so in such a way as to enhance their profits, and with good prospects of so doing. Extension of export markets for flours especially favored by the scheme could doubtless be found, but usually by concessions in price. Conceivably domestic flour, largely patents, would not rise in price as much as anticipated, because of better returns from clears. With millers, foreign consumers, and domestic consumers as potential participants in the bounty, it requires more than a little faith in the efficacy of competition to assume that the full benefit of the debenture on flour would be reflected back to the wheat grower.

Moreover, there is a large actual and potential foreign trade in other products of wheat, such as macaroni and other alimentary pastes, bread, biscuits, crackers, and other baked articles, dutiable at varying rates. In each of these products there are wide variations in the amount of wheat utilized. Upon what basis would the debenture rate be assessed? To grant too low a rate would seriously injure producers of such products, and might, in fact, partially defeat the purposes of the plan by admitting foreign wheat in the form of these products. If too high a rate were granted, it would constitute a bounty to producers, analogous to the indirect sugar bounties mentioned below, and much more likely to be met by retaliatory action by foreign governments than a like debenture upon wheat.

One could easily mention other puzzling aspects of the problem. What is certain is that the effects of the application of the debenture system to wheat and flour would be highly complex and would exert no little influence on business interests involved. What is highly uncertain is the precise nature and extent of this influence and the reflex action upon farm prices of wheat.

Conclusion

With no pretense to having exhausted this phase of the subject, we refrain from going farther because we do not wish to give an exaggerated view of the complications. Yet we cannot escape the inference that the operation of the scheme would not in fact be simple, direct, and undisturbing, but quite the reverse; and we consider it important that the existence of numerous complications should be realized. Experience, or fuller analysis in advance, might well reveal certain inherently beneficial incidental consequences of the plan; but in the main the probable incidental results appear to us either undesirable or neutral.

It is impossible to predict with any assurance, and would be impossible to measure in retrospect, the extent of any failure to reflect the debenture rate back to the grower or, what is more important, the extent to which domestic farm prices were not raised by the operation of the plan, above what they would otherwise have been, to the extent of the debenture rate. But we see no justification for accepting the optimistic reasoning of proponents of the debenture plan. Even in the absence of production stimulus and/or foreign retaliation, it seems to us more probable that the enhancement of farm prices, on the average, would not exceed 15 to 16 cents a bushel, instead of 21 cents. We regard as illusory the expectation that the reflection back to the farmer would be full, uniform, and universal; we should expect it to be incomplete, but to vary greatly in extent from region to region, from wheat to wheat, and from year to year.

Moreover, it must not be forgotten that farmers are consumers as well as producers. Wheat growers consume flour and other products that would be subject to price increases under the debenture plan. There is reason to believe that our sugar tariff yields less financial benefit to growers of sugar cane and sugar beets than it costs American farmers as a whole. As consumers, in consequence of the debenture plan, farmers would presumably pay somewhat higher prices for food, clothing, and tobacco, and probably also for other products that would be affected by higher costs (for materials and wages) resulting from application of the plan. To such an extent, the farmers' gain from higher farm prices would be offset.

In short, the actual results of the opera-

tion of the plan with respect to wheat can reasonably be expected to be quite different from the results commonly predicated —even if we disregard possibilities of stimulated production and foreign retaliations. There would, in our opinion, be no uniform raising of prices to growers to the approximate extent of the debenture rate. There is no reason to expect that any growers would gain by more than the debenture rate; there is reason to expect that those who get most will gain no more than 80 to 90 per cent of the debenture rate; there is reason to expect that in the aggregate wheat growers would gain by much less than this amount. Moreover, the system would create regional and local inequalities, benefiting most those regions and farmers that already contribute most of our export wheats. It would interject a factor making for changes in plantings, in uneconomic directions.

III. THE QUESTION OF STIMULUS TO PRODUCTION

In the foregoing discussion we have intentionally left out of account the bearing of the debenture system upon wheat acreage, production, and exports, and in turn upon prices. This important consideration now demands attention. Although it has figured a good deal in discussions of the proposal, there is little evidence that it has been followed through to sound conclusions.

The Effect on Acreage and Production

The natural economic effect of the debenture system would be to stimulate planting of the debenturable crops, to retard any existing tendency to contract acreage and to accentuate any existing tendency to expand acreage. The mere adoption of an avowedly price-raising policy would exert considerable influence in this direction; it would be inferred that, once embarked upon it, the government would seek to carry it through, raising rates if the initial ones failed to yield the desired results. Apart from this psychological influence, the initial enhancement of prices resulting from the plan, and the prospect of continued support to domestic prices under it, would exert a more tangible influence in the same direction.

The extent of the influence on planted acreage cannot be predicted with confidence. It would depend upon a complex of factors. One important factor would be the level of prices before the enhancement. If this were such as to make for reduced plantings and the prospective price improvement appeared moderate, the anticipated benefits might merely offset the tendency to contraction and the stimulus to expansion would be initially slight. On the other hand, if maintenance or expansion of acreage were encouraged by existing prices, the prospect for even a moderate enhancement of price might yield considerable stimulus. From 1924–25 to 1927–28 wheat prices were such as to encourage expansion of planted acreage, and expansion occurred. Wheat prices during the past year or so have tended in the opposite direction. How the acreage would actually change after the application of the plan would be determined in part by prices and acreage conditions existing at that time.

Another important factor would be the extent of price enhancement that was expected to result from the scheme in operation. If the theory of advocates of the debenture plan were generally accepted and wheat growers assumed that they could count upon nearly 21 cents a bushel more for their wheat, an addendum now and in future, as a result of the plan as compared with the absence of it, the stimulus to expansion would be substantial indeed. It would be particularly important in regions in which the tractor and combine are most readily used, with great economies in cost of production. Senator Capper of Kansas said in the Senate on May 4:[1]

> If you put this subsidy into effect we will increase our production of wheat in Kansas, through our use of big power on our level fields, in a way that will give the Treasury plenty of work to do.

It might also be important in the case of durum wheat, of which the harvested acreage has tended sharply upward in spite of moderate or low prices, rising from 3,826,000 acres in 1924 to a peak of 6,711,000

[1] *Congressional Record*, May 4, 1929, p. 874.

acres in 1928.[1] If we are correct in reasoning that the enhancement of price, apart from expansion of production, would be much less than has been ordinarily assumed, the stimulus might be correspondingly less. But in the first year or two it would not be the actual enhancement, as much as expectations of enhancement, that would exert the major influence; and these expectations would be more likely to be optimistic than skeptical or pessimistic.

A third factor, varying with different debenturable products, would be the possibilities for increase in acreage. So far as wheat is concerned, we consider that these possibilities are large. Our planted acreage increased remarkably during the latter part of the war and shortly after, reaching a peak of nearly 77 million acres for the crop of 1919. Subsequent contraction occurred under the influence of unfavorable prices, but only in one year (for the crop of 1924), when planting conditions constituted an important additional factor, has the planted acreage fallen appreciably below 60 million acres, which compares with a prewar *maximum* (crop of 1914) of less than 55 million. For the crop of 1928 the planted acreage has been estimated at 69 million. Newly developed machinery makes for expansion of acreage in three ways: by reducing planting, reaping, and threshing costs; by making it feasible to cultivate wheat on semi-arid lands hitherto unbroken because they were below the margin of profitable cultivation; and by favoring larger wheat acreage per farm. Thus it has led to notable increases in acreage in recent years on the western fringe of the Great Plains wheat belt. There are also widespread possibilities of increasing wheat acreage in the older sections in which wheat is extensively raised. It might be considerable in the large central area where the returns from barley and oats, to some extent also from rye and corn, have been regarded as unsatisfactory. Given a substantial price stimulus, our wheat area could easily and fairly quickly expand considerably above the peak that it reached in 1919; and even a more moderate stimulus could bring it up to this level and beyond.

[1] According to preliminary estimates, the acreage has been sharply reduced in 1929.

Another factor affecting the expansion would be the scope of the debenture plan. If it were applied to wheat alone, and not to products competing for the use of the same land, the stimulus would be especially pronounced. If it were applied generally to all cereals and to other export-surplus crops, and coupled with higher tariffs on flaxseed, sugar, dairy products, and other products, the influence would be less marked. But it seems quite unlikely that either the tariff or the debenture scheme could directly exert any marked influence upon prices and production of hay and oats, which are among the competing crops; and it could hardly affect corn as much as wheat. The net effect of a comprehensive application of the plan would almost certainly be an expansion of the acreage planted to wheat.

The effect on the volume of wheat produced would be exerted only through increase of planted acreage. Conditions determining abandonment of planted acreage, and yields per acre, would be unaffected. Variations in these conditions from year to year would cause, just as at present, considerable variations in the size of crops; but the variations would occur on a higher level because of the operation of the plan.

Another factor would be the extent to which the federal farm board, or wheat cooperatives, could restrain the tendency to increase acreage. They would unquestionably attempt to do so. How far they might succeed no one can tell. It must be admitted that past experience affords no ground for optimism here. The success could hardly be greater than with similar efforts made without resort to the debenture plan. It would probably be less, because the board's position would be in a sense self-inconsistent: with the debenture plan it would be seeking to raise prices, which tend to stimulate production; and by its advice it would seek to prevent this stimulus from taking effect.

We cannot escape the conclusion that a powerful stimulus to acreage and production of wheat would be given by the debenture plan, initially and for a time after. Though hesitating to suggest any figure, we believe that an increase of 10 per cent could easily be reached within three years, and it might be much greater. If we do not proph-

esy as large an expansion as would some critics of the plan,[1] it is because we do not believe that even the early enhancement of prices would be as great as the advocates of the measure have assumed, and also because we would stress the secondary consequences following from the early expansion of production. To the latter we now turn.

Secondary Consequences on Prices

If now, production were increased, within a comparatively brief period, above what it would otherwise be, let us say, by some 80 to 130 million bushels, our wheat available for export would be increased by, let us say, 100 to 150 million bushels. The effect of this increase on world prices would be too powerful to be overlooked. The international trade in wheat has only recently exceeded 900 million bushels, and net exports recently averaged much less. Prices in international markets are sensitive to the volume offered, in degrees depending upon the level of prices and the size and character of crops in importing countries. An addition of 100 to 150 million bushels to the international market supply would have a materially depressing effect on the world price. Statistical analyses have not yet been perfected so far as to permit close predictions as to price effects. These would certainly vary with the size and distribution of world wheat crops, the volume of export surpluses and the import requirements of major importing countries, and the level of international wheat prices. But a reduction of from 10 to 20 cents a bushel in international market prices, as a result of such an addition to our exports and apart from other influences making prices high or low, would be a not unreasonable expectation.

It could never be proved that such an expansion of production and exports was a response to the debenture stimulus, nor could it be demonstrated that the addition to exports had caused a price difference in world markets of any such extent. The effects would be spread over two or three years, or more, and inextricably mingled with the effects of other forces. But we feel reasonably confident, in the light of our studies of wheat crops, movements, and prices, that a tendency of some such magnitude would be set up by the application of a debenture plan to wheat.

If this be true, whither does it lead us? Clearly to this point, that the reduction in international wheat prices as a result of applying the plan might soon approach, if not actually reach, the price differentials that would be reflected back to farmers by the debenture system, without yielding the growers more than a limited fraction of the anticipated price benefits. What the farmer would really like is higher prices; if the debenture plan failed to yield him this, he could take cold comfort from assurances that the difference between Liverpool prices and his farm price was less than formerly. Quite probably some farmers would retain a net advantage from the operation of the scheme, if it worked as we have suggested; but others might be net losers by it. By and large, the wheat farmers who have found it profitable to expand their operations in recent years would be the ones to gain most, while many of those who have been hard put to it to make ends meet would suffer afresh from the stimulated competition of others, much as they have in recent years; and many who had responded to the stimulus of higher prices would be in serious difficulty.

This result would be disappointing, and otherwise unfortunate. The Treasury receipts would be depleted by larger sums than have been estimated on the basis of past exports, but without substantial benefit to farmers. Efforts to overcome the difficulty by raising debenture rates would lead to repetition of the process, and afford temporary relief, at increased cost to the Treasury, but without yielding any real solution. If the system were continued unchanged, a downward readjustment in acreage (and possibly land values) would tend to ensue. The readjustment would be greater, and more painful, if rates were re-

[1] The opposition to the export debenture on the part of the American Farm Bureau Federation was based in large part on the view that the export debenture would stimulate production more than the equalization fee plan. Professor J. D. Black, a believer in price-raising measures and a qualified endorser of the debenture plan, believes that of all price-raising devices the debenture plan might stimulate production the most; but he thinks that effective checks on expansion could be devised. Cf. his *Agricultural Reform in the United States* (New York, 1929), esp. pp. 311, 264–66.

duced, either for fiscal reasons or through application of a schedule calling for rate reductions in relation to expansion of acreage or production. Abandonment of the system would remove the prop to domestic prices, cause sharp declines toward a level more closely related to world prices, and precipitate a heavier task of readjustment. The stimulus would have been temporary, and the readjustment could be made, but not without considerable cost, falling perhaps more heavily on those less able to bear it.

The magnitude of the injury can be exaggerated, as has been done by some who accept the view of the proponents of the measure that, for a few years at least, farm prices would be raised by roughly the amount of the debenture rate. We do not share President Hoover's apprehension that the plan "would bring American agriculture to disaster," or agree in the emphasis employed in two of his specific points against the plan, which it is pertinent to quote here:

> 3. If the increased price did reflect to the farmer, the plan would stimulate overproduction and thereby increase world supply which would in turn depreciate world prices and consequently decrease the price which the farmer would receive and thereby defeat the plan. Stimulation of production has been the outstanding experience abroad where export subsidy has been applied. Overproduction will defeat the plan and then, upon its withdrawal, agriculture would be plunged into a catastrophe of deflation from overexpanded production. The farmer's difficulties to-day are in some part due to this process after the war.
>
> 4. The stimulation of production of certain commodities would disturb the whole basis of diversification in American agriculture, particularly in the cotton and wheat sections where great progress is now being made toward a more stable basis of agriculture.

It seems to us probable that the expansion of production and export would not go so far, that the plan would not be wholly self-defeating, and that the hopes of price enhancement would not prove wholly illusory. But Secretary Mellon's position, as expressed in the following excerpt, we regard as conservatively true:

> . . . . Exports would be stimulated, and, under the pressure of a consequent decreased domestic supply, domestic prices would rise. This would stimulate increased production. In the meanwhile, increased exports dumped on the world market would depress world prices, thus depriving the producer of the full benefit of the contemplated bounty. There is no doubt, I think, but that the effect of this program would be to depress world prices and to increase domestic prices and to give to the American producer a price higher than he would otherwise obtain, the increase, however, not being by the full amount of the cash bounty. But as production increased in this country under the stimulus of higher domestic prices there would be a constant tendency for the bounty benefit to melt away.

Even upon our moderate expectations of early price enhancement, and of expansion of production and export, the results would be notably smaller than the advocates of the scheme confidently promise. Unless production restraints could be imposed with marked success, the tendency would be for world prices to fall enough so that, even with the differentials that could be secured by American wheat growers in consequence of the scheme, the net gain would be slight.

A Longer View

Even if the early consequences were such as we are disposed to picture them, one must consider a somewhat longer and broader view. Theoretically it would seem reasonable to expect that such reduction in international prices of wheat and flour as we envisage would promote increased wheat consumption abroad, and discourage expansion and lead to contraction of wheat production abroad. No prompt reaction of this sort could be anticipated; but if we firmly adhered to the debenture system and it provoked no foreign retaliation, tendencies of this sort would be set up. If they should work out according to theory, an equilibrium might be reached whereby our net expansion would be largely offset by contraction abroad, to the end that world wheat prices would be reduced by the operation of the system to a net extent of, let us say, only 4 or 5 cents a bushel. In such case, our wheat growers would not be subjected to so considerable readjustment, and a larger net gain would eventually accrue to them as a result of persisting with the plan,[1] although part of their gain would be

[1] Dr. Holbrook Working of our staff is disposed to lay stress upon this view, and thus to think the less unfavorably of the eventual possibilities of the debenture plan.

absorbed by higher costs of production on portions of the increased acreage here.

There is unquestionably much validity to this reasoning, but we cannot follow it to the stated conclusions, essentially for realistic reasons.

The great competitors of the United States in the export of wheat are Canada, Argentina, and Australia. Unlike the United States, whose wheat exports have recently been in large part incidental, these countries are in the business of growing wheat for export, and ship overseas the bulk of their crops. They would presumably fear and probably experience injury in consequence of the application of the debenture plan here. Such depression in world wheat prices as resulted from our expanded production, under the stimulus afforded by the earlier operation of the plan, would be reflected back to their wheat growers in lower farm prices and lower income per acre. The reflection would be much more direct and certain than in the case of the United States, because so large and representative a proportion of the wheat produced in these countries goes abroad. But it is not clear that the result would be to check or to reverse agricultural expansion, specifically in wheat culture, in these countries. Still in the expansive, extractive stage of agriculture, they would be loath to have this expansion restrained. Further, agricultural expansion in Canada, and in large measure in Argentina and Australia as well, is not directly conditioned by operative returns. It is supported by directly or indirectly subsidized immigration, state policies of homesteading, railway settlement policies, the lure of new land, and the prospect of increases in land value. The new power farming is gaining headway in all three countries. For the next few years at least, perhaps for a decade, the wheat acreage of Canada, Argentina, and Australia will hardly respond, in any notable degree, to changes in the world price of wheat that might theoretically be expected to condition the rate of expansion of wheat culture.

We see no grounds for expecting that wheat culture in Russia, or wheat exports from Russia, will be materially affected by such changes in international prices as we have envisaged. Other factors, mainly domestic ones, are of dominant influence there. Even in Hungary, Roumania, and Jugo-Slavia, where lower levels of wheat prices might exert some repressive influence on acreage or export, domestic and regional factors have been largely influential in bringing about expansion of production and consumption without affecting exports *pari passu*. Without fuller knowledge than we possess concerning the factors determining the acreage, production, and export of wheat in these countries, we are unable to appraise the influence that would be exerted by lower world prices. In any event, these countries are, and seem likely to remain for several years, comparatively minor exporters and never net importers. At most, no large weight can be assigned to changes in acreage that the debenture plan might indirectly occasion there.

So far as most wheat-importing countries are concerned, expansion of consumption in line with existing trends is likely to continue, possibly with some acceleration. Those countries that are large producers of wheat, such as Germany, France, Spain, and Italy, seem likely to continue their policy of agricultural protection, and to raise tariff barriers higher as international wheat prices fall. It seems to us improbable that such countries will, in consequence of depression in world prices that might follow our expansion in wheat output, contract their wheat acreage and production materially.

Without going into all the cases, or into any in detail, we are constrained to believe that if even the eventual success of the debenture plan is to rest upon contraction of foreign acreage, or material restraint upon its expansion, it rests upon hope rather than realistic prospects. We do not question that some influence in the direction suggested by the theory would be exerted, but we believe the influence would be weak at least in the calculable future. Accordingly we cannot reckon this longer view as yielding major qualifications of the inferences already reached.

Flexible Rate Provisions

We have not yet mentioned in this discussion the provision for a "check upon overproduction," which was incorporated

in several 1928 debenture bills and also, by the Norris amendment, in Section 10 of the McNary bill. This device, in its three more prominent forms, merits examination before we consider the bearing of any such form.

The Ketcham bill of February 6, 1928 (H.R. 10568), contained the following provision (Sec. 7, *d*):

> In order to prevent undue stimulation in the production of any debenturable agricultural commodity, whenever the President finds prior to the beginning of a crop year from the report of the board hereinafter provided for or from any other source, that the probable production of any debenturable agricultural commodity during such crop year will exceed the average annual production of such debenturable agricultural commodity for the preceding five years, he shall by proclamation, prescribe that the export debenture rates for the commodity and the debenturable products of such commodity shall be reduced by the percentage fixed in subdivision (e) for the amount of the increase in production which the President finds will occur during such crop year. Such reductions shall become effective on the date fixed in such proclamation, not less than sixty days from the date of the issuance thereof, and shall remain in effect throughout such crop year. At the end of such crop year the export debenture rates for such debenturable agricultural commodity and the debenturable products of such commodity which were in effect immediately prior to the commencement of such crop year, shall become effective again unless the President under the provisions of this Act prescribes a change in such rates. The term "crop year," as used in this subdivision, means a twelve months' period beginning at a time designated by the President.

The schedule of reductions may be condensed as follows:

Estimated increase in production (*Per cent*)	Reduction in debenture rates (*Per cent*)
0–20	0
20–40	20
40–60	50
60–90	75
90 or more	99

To assist the President in determining the necessity for such reductions, the bill required investigation and report by the debenture board, and added that "In the conduct of any such investigation the board shall give reasonable public notice of its hearings and reasonable opportunity to parties interested to be present and to be heard."

Several minor points call for remark. The decision would presumably have to be based upon crop forecasts, made in the case of wheat on the basis of the report as of June 1. Instead of relying upon the official reports of the Crop Estimating Board in the Department of Agriculture, a special investigation with hearings is required. The proclamation would have to be made before the end of June, to apply to wheat, and could not be made or altered within the crop year, even if the harvest belied the forecast. The reduction would cease automatically at the end of the crop year. No reduction would be made unless the crop forecast was at least 20 per cent above the average of the five preceding crops, and the reduction in debenture rates could be only 20 per cent unless the prospective crop was 40 per cent or more above the same five-year average.

Now even a 20 per cent excess over the average of the five preceding crop years would represent a very substantial increase. In the case of wheat such an increase has been equaled or exceeded only three times in the last 35 years—1898, 1914, and 1915—and then only because of an extraordinary conjuncture of rising trend of acreage, record acreage harvested, and high yields per acre. An increase of as much as 40 per cent has not occurred. The extraordinary price stimulus during the war did not result, either in 1918 or in 1919, in a wheat crop as much as 20 per cent above the average of the preceding five years. The average crop of the past five years is calculated at 830.6 million bushels. Had the debenture plan been adopted in April 1928, it would have required, under the schedule given, a forecast crop for 1929 of about 1,000 million bushels to bring a reduction of 20 per cent in the debenture rate, and a forecast crop of 1,163 million to bring a reduction of more than 20 per cent in the rate. Moreover, if the stimulus to production should operate gradually, the average on which the percentage was based would also rise. It is safe to say that a reduction of more than 20 per cent in the debenture rate would probably never occur under this form of the scheme, and that it would be an exceptional year in which any reduction was made. It seems fairly obvious that rate reductions made on such a

schedule would be ineffective, either directly or indirectly, in preventing or checking substantial expansion of wheat acreage or output. The market response to enlarged outturn would presumably do much more.

The same schedule, with the same intent, was incorporated in the Norris amendment to the McNary bill; hence most of the above comments are pertinent to the latest form of the debenture proposal.[1]

The Jones bill of February 7, 1928 (H. R. 10656, Sec. 6), included much more flexible provisions, as follows:

> (b) Whenever the board finds that conditions justify such action it may reduce any debenture rate prescribed in subdivision (*a*) by an amount not exceeding 50 per centum of such rate, and may at any time after such reduction restore any such rate to any point not exceeding the rates set out in subdivision (*a*).
>
> (c) Whenever the board finds that the acreage planted in the United States during any year of any commodity covered by this Act is materially increased over the average annual acreage planted to such commodity, according to the estimates of the Department of Agriculture, during the five years next preceding such increase, the debenture rates for such commodity for such year shall be reduced by the board, on a percentage basis, in the inverse ratio, as nearly as the board finds practicable, to such acreage increase.

The identical Ketcham and Jones bills of April 11, 1928 (H. R. 12892, 12893) also contained flexible rate provisions which, while less flexible than the ones last quoted, were broader in scope, less cumbersome to put into effect, and more likely to be called into play than those of the earlier Ketcham bill and the McNary bill. To quote from Section 8 of the Ketcham-Jones bills:

> (b) In order to prevent undue stimulation of the production of any debenturable agricultural commodity, whenever the board finds that the average annual production of any debenturable livestock commodity or the average annual acreage of any other debenturable agricultural commodity for the last two preceding years has exceeded the average annual production or acreage, respectively, of such commodity for the period from the seventh to the third preceding year—then the board, after publicly declaring its finding, shall prescribe that the export debenture rates for the commodity and the debenturable products thereof shall be reduced or that the issuance of debentures therefor shall be suspended, as hereinafter prescribed for the amount of increase in production or acreage which the board finds has occurred. Any such reduction or suspension shall become effective at the commencement of the next calendar year and shall continue throughout such calendar year. No such reduction or suspension shall be made unless notice thereof is published at least thirty days before the commencement of such calendar year. At the end of such calendar year the export debenture rates which were in effect immediately prior to the commencement thereof shall again become effective unless the board under the provisions of this Act prescribes a change in such rates.

The prescribed schedule, as applicable to wheat, was as follows:

Increase in acreage[2] (*Per cent*)	Reduction in debenture rates (*Per cent*)
0–5	0
5–10	25
10–15	50
15 and over	100

Judging from the past, provisions of this sort would be called into play more frequently and more sharply. The more flexible provisions, however, raise more clearly certain broader considerations. The fear of reductions in debenture rates could hardly be a sufficient deterrent to expansion. Frequent readjustment of rates, down and up, would in itself have undesired incidental effects. Reductions in rates would tend to be made in years of large world production, so that the economic forces making for low prices would be reinforced by the reduction; conversely, rates might be at their maximum when production was less abundant and price more satisfactory. In any event, the instability of prices, and in most cases also the variations in farm incomes, would presumably be intensified.

The dilemma seems impossible to avoid. The less flexible provisions would not be called into play, or if mildly called into play they would exert comparatively little influence in preventing such an expansion of production as would minimize the price-raising objects of the plan. The more flexible provisions would exert somewhat more influence in checking expansion of production, but their application would intensify risks and price fluctuations, with untoward direct consequences; and without entirely

[1] Cf. Senator Capper's speech in the Senate, *Congressional Record*, May 4, 1929, p. 876.

[2] The language does not make clear whether planted or harvested acreage was meant.

eliminating the tendency to stimulate production, with its objectionable consequences, they would tend to eliminate the operation of the plan itself. Conceivably better schedules, varying with different products, could be devised; but we see no prospect that any schedule could be drawn up that would be free from the basic objections just mentioned.

Conclusions

It is beyond the scope of this study to consider other commodities one by one. Each presents peculiarities, and the plan would work better with some, less well with others. Suffice it to say that we believe that wheat is a fair average sample of the possible list of debenturable commodities. We see no prospect that the debenture system, as applied to one, a few, or a long list of commodities, would in fact raise farm prices at once by the amount of the debenture rates. We see no reasonable probability that it would, over a period of years, cause farm prices to stand on a level higher than would otherwise obtain by more than a fraction of the debenture rate. At best, we think it highly improbable that the net gain to farmers would reach two-thirds of the debenture rate, and more probable that it would run one-fourth to one-half of the debenture rate, even if there were no retaliation abroad. It would not, in our opinion, really make the tariff effective, even by half, or yield agriculture the promised equality with industry, or prove, as the National Grange expects, "a sound method of restoring agricultural prosperity in the United States."

We have already adverted to the impossibility of predicting reliably how the plan would actually work, and of appraising its actual results. In concluding this section we must emphasize the point that its reputation might be much better or much worse than accurate appraisal of the facts would justify. Precisely the same comments could be made on the protective tariff.

Even under ordinary conditions, experts have serious difficulty in ascertaining the relative weight of different forces that in combination determine acreage, production, movements, and prices of wheat. The debenture plan would be, not a distinct factor in an otherwise stable situation, but another variable in a complex, confused, and changing situation. At various stages in the operation of the plan, it would probably be judged not by what it had actually done for good or ill, for most of this could not be convincingly demonstrated, but by what actually transpired. If it were inaugurated at a time of low wheat prices and there followed a period of rising prices, the debenture system would be given undue credit for the event, or at least would be reasonably safe from attack. The Canadian Wheat Pool was thus most fortunate in being inaugurated in 1924, when wheat prices recovered sharply from extreme depression. On the other hand, if the scheme were initiated early in a period when prices were otherwise tending to decline, it might suffer undeservedly excessive condemnation for causing the decline.

It seems clear that the short-time operation of the debenture plan might be quite different from the long-time operation, if persisted in. Also, it is clear that the plan would work differently with stable crops and uniform year-after-year world wheat prices than under actual circumstances of widely varying crops and prices. Relative wheat shortage and high world price alternate irregularly with relative glut and low world price, despite an upward trend of wheat production in the world. In a year of relative world shortage of wheat with high price, even if the United States had an exaggerated surplus due to the export debenture, the deterrent price influence of this enlarged surplus would be obscured in the rising world wheat price. Under such circumstances the export debenture would seem to be, and in fact might be, reflected in high degree to producers. In a year of relative world glut of wheat with low price, an exaggerated surplus in the United States due to the export debenture would cause a disproportionate depression of price. Under these circumstances the export debenture would not seem, or indeed tend, to be reflected to producers in high degree. With a series of years of uniformly favorable circumstances, the plan might seem to lead to favorable results; on the other hand, it

might be discredited in the first year or two of trial, due to unfortuitous conjuncture of unfavorable circumstances.

In our own analysis we have sought, so far as possible, to envisage the possible and probable consequences of the debenture plan itself. These furnish the principal basis for our inferences as to the outcome. We realize, however, that adoption, continuation, modification, or abandonment of the system might rest largely upon misunderstanding, or upon other and perhaps irrelevant considerations. But we believe that the subject is of sufficient importance to warrant serious efforts to think through the relevant considerations in advance.

IV. THE BEARING OF FOREIGN EXPERIENCE

Spokesmen for the debenture plan have frequently referred to foreign experience with analogous devices, and have given the impression that such experience directly supports their theory as to price-raising effects and benefits to farmers. They have asserted that the plan is "based upon a lot of world experience in making the tariff effective for agriculture," and can be "regarded as a tried system," with "benefit to agriculture in each case." There have indeed been innumerable instances of export bounties and somewhat analogous devices applied to agricultural products by a large number of nations. Without undertaking extensive original research in this field, we have nevertheless looked into the available literature on this subject[1] at least as fully as those who cite it in behalf of the debenture plan appear to have done. This examination leads us to believe that the advocates of the plan have seriously misconstrued the foreign experience.

The German Import Certificate System

The most prominent parallel has been drawn with Germany's import certificate system,[2] which furnished the inspiration for the formulation of the export debenture plan. It was in force in Germany from 1894 to 1914, and was re-established in 1925. A similar system was in vogue in France, from 1850 for grain, and from 1851 to 1888 for iron. Czechoslovakia adopted the German system in 1926, and in the same year Sweden copied it on a more limited scale.[3] The post-war experience has been too short to be of clear-cut significance,[4] but the re-establishment of the system in Germany and its adoption elsewhere speaks in its favor.

In several respects the German import certificate system is quite like the proposed debenture system. Exporters of specified agricultural products of Germany, chiefly cereals and pulses, and specified manufactures thereof (and since April 15, 1928, live hogs and certain pork products), obtain from the Treasury upon exportation negotiable certificates representing a value corresponding to minimum tariff rates on imports of the same commodity. Within a limited period—formerly 6 months or 3 months, now 9 months—from date of issue, these import certificates (*Einfuhrscheine*) may be tendered at par in payment of customs duties on certain imports. Originally, the import certificates granted on the export of wheat or flour were good only for duties on imported wheat, and so with other products; but from 1906 they were tenderable for duties on any one of the same list of unmanufactured products. For some years prior to 1911, under certain regulations, they could be used alternatively to pay purely revenue duties imposed on certain products such as were not produced in Germany (e.g., coffee, cocoa, petroleum).

In form, then, the German import certificates are essentially equivalent to the proposed export debentures, except in a few

[1] A valuable guide to the literature of the subject is given by a recent publication of the U.S. Department of Agriculture: Bureau of Agricultural Economics, *Bounties on Agricultural Products: A Selected Bibliography*, compiled by A. M. Hannay, (mimeographed) July 1927. A convenient summary is given in Josef Grunzel, *Economic Protectionism* (Oxford, 1916), pp. 200–29.

[2] For a somewhat fuller discussion, with references, see J. S. Davis, "The Export Debenture Plan for Aid to Agriculture," in *Quarterly Journal of Economics*, February 1929, XLIII, 263–68.

[3] See House Committee on Agriculture, *Agricultural Relief (Export Debenture Plan) Hearings*, February 10, 1928, Serial E—Part 5, pp. 386–88.

[4] The same may be said of Australia's experiment with unofficial export bounties on butter, under the so-called Paterson plan in force since early in 1926, to which brief reference is made below, pp. 336–37.

particulars. The rates are identical with effective tariff rates, as proposed in the earliest debenture bills, and not lower as proposed in the later bills. They apply to a somewhat smaller list of export products. The certificates are good for a somewhat shorter period. They can be tendered in payment of customs duties on certain products only. In practice the certificates usually sell at only a slight discount, though sometimes it is more than nominal. So far, the similarities between the two systems are more important than the differences.

When, however, we compare the German system and the proposed debenture plan with respect to purpose, conditions of application, and effects, we find some striking contrasts.

The debenture plan is designed to apply here only to products of which the United States produces more or less considerable export surpluses. Germany, however, is a net importer of the products to which the import certificate system is applied. When the plan was adopted she was a net importer of each of these products. During the operation of the system she became a fairly regular net exporter of two (rye and oats), but continued regularly a heavy net importer of the group of products as a whole. This difference, as we shall see, is fundamental.

The purpose of the debenture plan is to raise farm prices of the debenturable products throughout the United States and thereby to contribute substantially to increases in farming income. The German system had and has no such object, but a far more modest one. German agriculture has recently been suffering acute depression, in part from causes peculiar to Germany, in part from the same causes that have caused grave difficulties here. But a German official, in writing recently of the crisis and the measures that have been taken to meet it, makes no mention of the re-establishment of the import certificate system.[1] The system was intended to correct a regional discrimination that happened to result from the enforcement of high protective duties on agricultural products; and to prevent certain avoidable and costly disturbances to the grain trade that were caused by the import duties.

A brief explanation should make this clear. As a whole Germany produces less grain and, indeed, of most agricultural products, than she consumes. For military and other reasons, Germany has sought at different times, by various means, to check a tendency to become predominantly an urban, industrial nation, increasingly dependent on imports of foodstuffs. Hence the adoption of an agrarian protective policy in 1879 and its extension and persistence in subsequent years. But northeastern Germany is predominantly agricultural, with a regional surplus of grain and other farm products. For much of this surplus the best markets lay abroad, chiefly in Great Britain and Scandinavian countries. Shipment costs via the Baltic Sea were lower to these markets than to western, central, and southern Germany by rail or water. Furthermore, the wheat of this region was of such a character (low in gluten content) that it was more in demand abroad than in the rest of Germany, which produces somewhat similar soft wheat. To be utilized to best advantage it had to be mixed with hard wheats. The business of mixing this German wheat with Russian wheat, for export, had long been a profitable enterprise in German Baltic ports; today such grain can be mixed with Canadian wheat in British and North European centers. When the tariff duties were imposed, they were effective in raising prices of these farm products in most of Germany, practically to the full amount of the duty. But the east German farmers did not gain nearly as much. Shipped westward within Germany, their surplus had to bear heavy costs of transportation and a special discount for quality. Nevertheless they found it more profitable to accept a moderate increase in price for domestic sale in preference to export prices. Hence the mixing business and the export trade shrank severely, and protests of merchants and shipping interests reinforced complaints of discrimination from the politically powerful landlords (*Junkers*).

The system was designed to remove this discrimination and to permit the restora-

[1] Dr. R. E. Bose, "Aid to German Agriculture," in *The Annals*, March 1929, CLXII, 361–66.

tion of trade to its usual course. Baltic exporters, receiving import certificates, could bid higher for the grain in question, and still make normal profits on mixing and export.[1] The farmers of the region could get virtually the equivalent of the export price plus the duty, and thus secure as much benefit from the composite system as farmers elsewhere in Germany obtained simply from the tariff. German milling interests generally preferred to use more of imported hard wheats, and to let much of eastern Germany's surplus go to foreign markets. Broadly speaking, the device worked as anticipated, and met with general approval, not as an independent policy on behalf of German agriculture, but as a minor complement of the tariff system that prevented needless discrimination and disturbance to trade. It cost the Treasury little or nothing, because imports increased by practically the amount of the exports, and the customs revenues were not demonstrably reduced. It has apparently provoked no retaliation abroad.

Now the debenture plan is not here proposed as a correction of regional discriminations or uneconomical disturbances to trade consequent upon existing duties on agricultural products. Indeed, as we have already seen, it would itself introduce certain regional discriminations in agriculture, and these not in economic directions. Whereas the German system is regarded as part of a protective policy designed to stimulate Germany's production of agricultural products, the debenture plan is designed to make farmers more prosperous without stimulating production. Indeed, it is presented as a measure of surplus *control*,[2] and increase of production is regarded, not as a good to be attained, but as an evil to be guarded against. In practice, when the German certificates were made interchangeable after 1906, the system operated to stimulate production of rye and oats, somewhat at the expense of wheat and barley, with the result that Germany (in part from other causes) became ordinarily a net exporter of rye and oats and a larger net importer of wheat and barley. This experience tends to strengthen the prospect, already mentioned, that the debenture plan would lead to a readjustment in the relative volume of farm products, not necessarily in the interests of the national economy of the United States.

Granting the success of the German scheme in achieving its objects without significant disadvantages, it does not follow that the debenture plan, if adopted here, would achieve its ends. No one claims for the German system the credit for achieving such objects as lie in the minds of proponents of the debenture system. If the means adopted are similar, the differences in aims and conditions of application are of outstanding importance.

It is conceivable that we might adopt the German import certificate system as such, with eventual advantage to our national economy. In effect, the German grain trade is permitted to bring in a bushel of hard wheat duty-free as a stand-off to the export of a bushel of domestic soft wheat or a larger amount of rye or barley. The United States, as we have seen, is ordinarily an exporter of Pacific wheat, hard winter wheat, durum spring wheat, and of rye. We are practically on a domestic basis for high-grade hard spring wheat, and each year witnesses the importation of a small amount of Canadian hard spring wheat for domestic consumption. If we really wish to apply the German system of import certificates here, we should grant to exporters of soft wheat, hard winter wheat, durum wheat, and rye, certificates entitling the bearer to import duty-free a corresponding volume of Canadian hard spring wheat. This would tend to correct an effective discrimination whereby growers of hard spring wheat now get the lion's share of the benefit from the tariff on wheat, while many growers, in many regions, gain nothing from it at all. Such a policy might be expected to simplify milling problems and make possible a more economical disposition of our grain supplies and in time, indeed, a more effective utilization of our national agricultural resources. But in our circumstances as a net exporter it would largely eliminate such benefits as the wheat tariff yields to northwestern farmers, and involve radical readjustments in agriculture

[1] Since the war, which cut off imports of Russian wheat, the mixing business has not revived, for lack of wheat supplies from Russia.

[2] See below, pp. 341–42.

of our northwestern states. We cannot believe that such a proposal would be acceptable to farmer spokesmen. But we suggest that if this more direct analogy were fully appreciated, Germany's experience with import certificates would be less frequently quoted in support of an American export debenture plan.

English Grain Export Bounties

English experience with export bounties on grain is also cited on behalf of the debenture plan. Though unfortunately too little is authoritatively known concerning its real influence on English agriculture, some discussion of the system is pertinent here.

The first "corn bounty" legislation, long forgotten until its discovery a few years ago, was passed in 1673 and expired by limitation after having been in force about five years.[1] It provided for payments of specified cash bounties on the export of wheat, rye, barley, and malt, in ground or unground form, whenever port prices should stand at or below stated levels (and not when they stood higher), as follows:

	Wheat	Rye	Barley or malt
Price in port, per quarter of 480 lbs.....	48*s.*	32*s.*	24*s.*
Bounty per quarter...	5*s.*	3*s.* 6*d.*	2*s.* 6*d.*

This provision was inconspicuously inserted near the end of a long statute which granted a large subsidy to the crown. Its object was put thus:

> And to the end that all Owners of Land whereupon this Taxe [direct tax of £1,238,750 to be raised within 18 months] principally lyeth may be the better enabled to pay the same by rendering the labours of the husbandmen in raising corne and graine more valuable by exportation of the same into forreigne parts which now is already at a very low rate and that the Nation in generall may have her stocke increased by the returns thereof. . . . .

It was designed to raise domestic grain prices and enhance farming profits, not as a measure of restoring agricultural prosperity, but in order that the landowners might be better able to meet a new direct tax. It was also intended to expand grain exports, and thereby to attract imports of precious metals, to which the mercantilistic doctrines of the period attached large and unmerited importance. It was intended, like the new tax, to be temporary. It was to be effective only if and when domestic prices stood below certain levels. Moreover, it was engrafted upon an ancient and complex system of regulation of the grain trade, domestic and international, adopted with a view to stimulating production, limiting price fluctuations, and ensuring the nation's food supply. The contrasts with the debenture plan are obvious.

The detailed consequences of the measure are not known, and the historian of the act admits inability to appraise its full significance. He finds, however, that grain exports, which had long been small, increased greatly, in part because of the stimulus to export and production afforded by the bounty; and that "the drain upon the treasury was considerable and came at an inopportune moment."

The policy lapsed for a decade, but in 1689 virtually the same provisions were enacted afresh, without limitation of time, and the preamble recites that experience had demonstrated the success of such a measure in achieving stated objectives. The corn bounty policy remained nominally in force until 1814. It was modified from time to time, suspended seventeen times between 1698 and 1773 when dearth was anticipated, and inoperative under its own limitations for most of the last 50 years before its repeal, as England ceased to be a net exporter of grain.

During much of its history the corn bounty system was the subject of much controversy, and neither contemporary nor later writers have agreed in their interpretation of the results. Two great English economists, Adam Smith in his *Wealth of Nations*,[2] and David Ricardo in his *Principles of Political Economy*,[3] condemned the system with emphasis, but on the basis of different interpretations of its results. Later economists and economic historians have not agreed upon authoritative answers to questions that we should like to ask about

[1] See N. S. B. Gras, *The Evolution of the English Corn Market from the Twelfth to the Eighteenth Century* (Cambridge, Mass., 1915), pp. 112–14, 144–47, 245, 253–54, 418–20.

[2] Third edition, Book IV, Chapters 1–8, especially Chapter 5.

[3] Chapters 22, 23.

it.[1] Grain production certainly increased during the bounty régime, but improvements in agriculture and an unusual preponderance of favorable seasons contributed largely to this result, and how much was the result of the bounty stimulus cannot be ascertained. Thorold Rogers, author of a monumental *History of Agriculture and Prices in England*,[2] says:

> The bounty system of the Revolution [1689] was in principle quite as indefensible as the corn law of the Restoration; but it tended to defeat its own ends by extending the area of cultivation, and I have little doubt that much of the plenty which characterised the first half of the eighteenth century was due to the bounty on exported corn [grain], and to gambling for the bounty.

Even so, England ceased to be a regular net exporter of grain after about 1765, and a net exporter at all some twenty-five years later.

Whether because of or merely in spite of the policy, English grain prices ran low until England's consumption came to exceed her production; indeed, about as low as in France, where export was prohibited. Some careful students have concluded that the system furnished a material stimulus to production, promoted the exports of especially the poorer qualities of grain, and cost the treasury considerable sums, but did not cause material injury to consumers because the direct tendency to raise prices was offset by increased output, and when prices rose above a certain point the bounty was withdrawn. Conceivably it may have tended, as it was applied, to mitigate the extreme variations in prices from year to year which had been an evil characteristic of the English grain trade. Whether grain prices would have averaged lower if the bounty system had not been in force cannot be ascertained; but there is no indication that they were permanently held above what they would otherwise have been, by anything like the extent of the bounty, if at all. How much the English farmers and landowners really gained by it is not clear; but it certainly did not ensure continuous agricultural prosperity or prevent complaints of "ruinous prices" of the farm products that were subject to the bounty.

If it is difficult to learn the true significance of the English grain bounties for the national economy, and particularly England's agriculture, it is at least equally difficult to draw reliable inferences concerning the meaning of this experience for the United States in connection with the proposed debenture plan. Certainly the conditions are widely different as to agriculture, grain merchandising, foreign trade, and economic relations in general. The export debenture plan is significantly different in being applicable regardless of price, and in practice it would presumably intensify price instability instead of moderating it.[3] So far as any inferences are warranted, however, they seem to us on the whole to confirm rather than to refute the reasoning we have set forth as to the probable operation of the debenture plan.

Sugar Bounties

Next to the English corn bounties, much more widespread, and much more recent, the sugar bounties of the second half of the nineteenth century constitute easily the most prominent application of export bounties to any agricultural product.[4] These first grew up indirectly in connection with efforts to collect taxes on sugar

[1] Cf. J. S. Nicholson, *The History of the English Corn Laws* (London, 1904), *passim*.

[2] The full title includes the words, *From the Year After the Oxford Parliament (1259) to the Commencement of the Continental War (1793)* . . . . by James E. Thorold Rogers (7 vols. in 8, Oxford, 1866–1902). The passage quoted is in Vol. V, p. 784.

[3] See below, pp. 342–43.

[4] Cf. Josef Grunzel, *Economic Protectionism* (Oxford, 1916), pp. 207–13. For other extensive literature see the bibliography cited above, p. 330. The following paragraph in Secretary Mellon's letter of April 19, 1929, to Senator McNary contains some truth but is not altogether accurate:

"The experience of European countries with bounties on sugar may be of interest in connection with this proposal for a bounty on American agricultural products. The original purpose of the foreign bounties was to stimulate production rather than to increase the income of the agricultural population. A cash bounty was paid the producers of sugar and the results desired were obtained. In Germany it was planned to cover the costs of the production bounty on sugar by collections from an internal-revenue tax on the domestic consumption of sugar, but production increased so far out of proportion to the domestic consumption that within a comparatively few years the net effect was not to produce revenue. Some time thereafter the sugar bounties so far exceeded the revenue from the sugar tax that the treasury sustained a considerable loss, while sugar was being sold abroad at considerably less than the domestic price, and somewhat less than the actual cost of production. Consequently, the bounties on such sugar production had to be removed. There were no limits to production in the granting of such bounties."

consumption, coupled with a policy of refunding the tax in case of exportation. Taxes were levied, for reasons of administrative convenience, on the beets or the sap on the basis of an assumed percentage of yield. The refund upon exportation of sugar was made on the same assumption. In consequence, producers who obtained better yields were able to get a concealed export bounty varying with their technical efficiency. Though not established for the benefit of agriculture, the bounty system promoted the expansion of sugar beet cultivation, beet sugar production, and sugar exports. Hence, although it cost national treasuries heavily, it could not easily be abandoned. To simplify the system and prevent discriminations, the refund of duty was supplanted in several countries (e.g. Austria-Hungary, 1888; Germany, 1891; France, 1897) by outright export bounties.

The policy succeeded in maintaining higher prices for sugar in the producing countries than in their foreign markets, but the results were by no means satisfactory. National treasuries suffered net losses. Production was overstimulated and sugar prices fell, partly in consequence of increased production of cane sugar abroad, to what were regarded as levels ruinous to beet growers. Foreign manufacturers of products containing sugar were given the advantage of getting the raw material at prices below cost of production. Numerous international complications arose and retaliations were provoked. Only the firm adherence to free-trade principles and to a strict interpretation of its commercial treaties prevented the British government from imposing countervailing duties, as favored by her sugar-producing colonies and proposed, for example, by a Parliamentary investigating commission that reported in 1880. The United States, by the McKinley Tariff Act of 1890, offered bounties to American sugar producers on the one hand, and on the other imposed tariff duties on "bounty-fed" sugar produced abroad. The Wilson Tariff Act of 1894, which abolished our bounty and restored tariff duties for revenue purposes, placed a uniform supertax of 1 mill per pound on imported sugar on which the producing country had paid a bounty, either direct or indirect. The Dingley Tariff Act of 1897 required the levy of countervailing duties equivalent to such bounties, as determined by the Secretary of the Treasury. With respect to sugar imported into India, Great Britain went still farther in 1899. Finally, after repeated negotiations and conferences had failed to bring about the abolition of the system, the Balfour Government of Great Britain announced that it would impose equalizing duties unless an agreement were reached for removal of the bounties and reduction in sugar import duties. This forced the adoption in 1903 of the international Brussels Sugar Convention, drawn up in March 1902, which bound the contracting countries to remove all bounties on sugar production or export, direct or indirect; to reduce import duties on sugar; and to levy countervailing duties on sugar coming from other countries in which such bounties were paid. The agreement was not universally subscribed to, and by subsequent action the Convention was variously modified; but the extensive sugar bounty system has never been restored.

For reasons that will probably be obvious, the sugar bounty experience has been accorded no emphasis by the advocates of the debenture plan, in spite of its pertinence. It is hard to believe that they could point with satisfaction to the cost to national treasuries, the excessive stimulus to production, the subsequent depression of prices to growers, the effective aid to foreign manufacturers, the disturbance to production and international trade, the international complications, the difficulty of abandoning practices once they were firmly established, and the final abolition of the system with inevitably difficult readjustments. We would not exaggerate. Doubtless the sugar bounties were far from being wholly evil, and accomplished some good. The debenture plan is not a precise equivalent. But taken as a whole this group of foreign experience fairly constitutes a warning, not a favorable example.

In the light of the foregoing discussion, it seems to us reasonably clear that a serious misinterpretation of foreign experience with import certificates, export bounties, and like devices is involved in arguing that such experience shows that the proposed debenture plan would restore and maintain

agricultural prosperity in the United States. No country has adopted a plan of such broad scope, with corresponding limitations, under anything like comparable conditions, or with any such far-reaching purpose. The success of somewhat analogous schemes abroad has been far from unequivocal, even in attaining their particular objectives; and some have given rise to serious undesired complications. We are not ready to conclude, on the basis of limited study, that recorded foreign experience implies that the debenture plan would be a mild or disastrous failure; but we believe that it tends to bear out rather than to contradict our reasoning as to the probable outcome of the debenture system if it should be put into operation.

V. POTENTIAL REACTIONS OF FOREIGN GOVERNMENTS

The international complications and retaliatory actions aroused by the sugar bounties lead naturally to the question whether the debenture plan, if applied, might not provoke similar reactions. Thus far, in considering how the plan might work, we have assumed that foreign governments would take no notice of it, regard it as a purely domestic concern of ours, raise no objection, or at least take no positive steps of resistance or reprisal. The proponents of the plan commonly assume, and sometimes argue, that this situation would prevail. As it happens, one of the more important reasons why the debenture form has been favored instead of a cash bounty is that it would be less liable to arouse criticism abroad. It does not appear that the German certificate system has evoked significant complaint or any resistance in foreign countries. Would the debenture plan, drafted on the same model, do more? On this point again we cannot prophesy with assurance. But it is essential to consider the possibilities and probabilities, and their bearing upon the success of the scheme.

Possible Forms of Reprisal

Governmental retaliation might take any one of three principal forms: (1) imposition of countervailing or "equalizing" duties on the "bounty-fed articles"; (2) application of anti-dumping legislation; (3) raising duties or imposing other restrictions upon our exports, including other articles than those subject to the debenture plan.[1]

[1] Senator Smoot considered this matter at some length in a speech in the Senate on April 30, 1929, which furnishes part of the basis for the following discussion. See *Congressional Record*, May 1, 1929, pp. 736–43.

The anti-bounty legislation may be illustrated by Section 303 of our tariff law (1922), which embodies a policy first adopted in the McKinley tariff of 1890 and incorporated essentially in the present form in the Dingley tariff of 1897 and subsequent tariff acts. It runs as follows:

> That whenever any country, dependency, colony, province, or other political subdivision of government, person, partnership, association, cartel, or corporation shall pay or bestow, directly or indirectly, any bounty or grant upon the manufacture or production or export of any article or merchandise manufactured or produced in such country, dependency, colony, province, or other political subdivision of government, and such article or merchandise is dutiable under the provisions of this Act, then upon the importation of any such article or merchandise into the United States, whether the same shall be imported directly from the country of production or otherwise, and whether such article or merchandise is imported in the same condition as when exported from the country of production or has been changed in condition by remanufacture or otherwise, there shall be levied and paid, in all such cases, in addition to the duties otherwise imposed by the Act, an additional duty equal to the net amount of such bounty or grant, however the same be paid or bestowed. The net amount of all such bounties or grants shall be from time to time ascertained, determined, and declared by the Secretary of the Treasury, who shall make all needful regulations for the identification of such articles and merchandise and for the assessment and collection of such additional duties.

It will be observed that the Secretary of the Treasury is not merely authorized but required to act in such cases. As we have already noted, such action was taken by the United States in the case of sugar bounties, direct or indirect. Within the past three years, when Australian butter producers adopted the Paterson plan under which an export bonus was paid on butter exports (not from the Commonwealth Treasury,

but out of a levy upon producers, and even without any legislative authorization), a countervailing duty on Australian butter was established by the United States. Even Canada, a sister of Australia in the British "Commonwealth of Nations," did likewise. There would seem to be no question that the adoption of the debenture plan by a foreign nation would lead to prompt action here under existing legislation. We should therefore have no official ground for complaint in case any or all foreign governments met our debenture plan in the same way.

The existing tariff laws of several other nations contain provisions more or less similar, though most of them are less explicit, and some do not make administrative action mandatory. Senator Smoot, in a recent speech in the Senate, presented quotations or translations of such provisions in force in Austria, Belgium, Czechoslovakia, France, Portugal, Spain, and Switzerland, and in Japan, Australia, New Zealand, and the Union of South Africa.[1]

If countervailing duties were universally imposed on our exports of debenturable products, it is fairly obvious that the plan would fail of its purpose for this reason alone. The exporters would get their debentures on exports of debenturable goods, but they would not be able to sell these goods abroad for as much as if the plan did not exist. In competition abroad with goods from other export sources, our exports would be subject to special import duties equal to the debenture rate. Importers therefore could afford to buy them only at a c.i.f. cost below the cost of competing goods to the extent of the special duty. American exporters could therefore afford to buy these goods in this country at no higher price than if the debenture scheme were not in operation. The farmer's selling price would not be raised. In addition, our Treasury would lose the amount of the debenture issues, while foreign treasuries would gain correspondingly. Not only would the plan fail to afford farm relief, but there would be no offset to the Treasury loss. The result would be humiliating and expensive failure. Indeed, if such policies were generally adopted abroad, the system would have no chance to operate at all.

In the second place, either in connection with provisions of the type just mentioned or independent of them, anti-dumping legislation exists under which duties may be raised to prevent the "unfair competition" from imported goods sold for export at prices below those prevailing in the producing country. The Department of Commerce, in its recent memorandum on the debenture plan, stated:[2]

> It should be pointed out that practically all countries, with two or three exceptions, have antidumping laws. It is possible the debenture plan would be interpreted as an export bounty and export dumping, since products would be sold in foreign countries at lower prices than in this country.

Examples are given in Senator Smoot's speech already mentioned,[3] chiefly from British dominions. President Hoover evidently referred to both types of reprisal in his eighth point against the debenture plan:

> Export bounties are recognized by many nations as one form of dumping. I am advised that a similar action by another nation would be construed as a violation of our own laws. Such laws are in force in the principal countries of our export markets and to protect their own agriculture would probably lead to action which would nullify the subsidy given by us.

The probabilities of the case we shall shortly consider; but it must be remarked here that existing legislation and practice abroad does not necessarily set limits to possible action. Extension and strengthening of present statutes and regulations are readily conceivable.

In the third place, there is the possibility that countries which do not import such products as we may classify as debenturable, but which export competitive products themselves, would seek to meet our measure in one way or another. Last May, when American railroads reduced export rates on wheat and flour, ostensibly in an effort to "assist in effecting a reduction of the surplus through exportation to avert, if possible, a lowering of prices,"[4] the Canadian railways forthwith announced com-

[1] *Congressional Record*, May 1, 1929, pp. 739–40.

[2] *Ibid.*, April 22, 1929, p. 287.

[3] *Ibid.*, May 1, 1929, pp. 740–41.

[4] Approved by the Interstate Commerce Commission to be effective from May 29 to September 30, 1929. See *E. B. Boyd's Export Freight Tariff No. 203*, issued by E. B. Boyd, Agent, Chicago, Ill.

parable rate reductions. Argentina has vigorously protested against our tariff legislation affecting her exports of corn and meats, and might conceivably meet the adoption of the debenture plan, as tending to affect adversely her exports of grain and meats, by raising duties on products that we export to her. Countries that foresaw or experienced real or apparent injury to their trade or agriculture might undertake to strike back in whatever way seemed most likely to be effective. Our own resistance to foreign government measures designed to raise or hold up prices of coffee and rubber furnishes precedents, as well as illustrations of indirect means of action.

Probable Reactions

We are thus led to admit the proposition voiced by Senator Vandenberg, that "as a practical affair . . . . the export bounty can work only by the sufferance of foreign governments."[1] It would be rash to assume, however, that retaliation or reprisal, direct or indirect, would be universal, or even so general as to nullify the intent of the plan. We can hardly follow Secretary Mellon in his view of the probable outcome, as expressed in his recent letter to Senator McNary:[2]

> Moreover, it is hardly to be assumed that foreign countries with important agricultural interests to protect will permit their producers to be subjected to a price war subsidized from the United States Treasury without adopting protective measures. It is highly probable, therefore, that they will levy countervailing tariff rates equal in amount to our export bounty, thus entirely nullifying the effect of the latter as an aid to our producers and drawing the amount of the bounty funds into their own treasur[i]es. The United States was one of the first nations to place countervailing duties against the bounty-produced sugars of the various European countries.

In the first place, it is quite improbable that operation under the plan would be interpreted as "a price war subsidized from the United States Treasury." This is certainly remote from the intentions of proponents of the plan, who have usually reasoned, indeed, as if export prices would be unaffected by it. Any reductions that might take place in export prices would be quite as contrary to the desires of American farmers, or advocates of the debenture plan, as to the desires of farmers abroad. Probably the fact that the measure does not seek to stimulate production or exports, but merely to improve the position of American farmers, would have some mollifying influence on foreign governments who would be aroused by a bounty imposed with the object of stimulating production.

But the intent would not wholly determine the issue. Fears might be as influential as more tangible facts. Sentiment would play a large rôle. The results would count also, and we have good reason to believe that the tendency of the measure would be to stimulate production and exports, and to lower world prices of the debenturable products. The course of actual developments would be important, whether or not the plan was properly chargeable with what proved to happen. Reprisals would be far more likely if our exports did expand materially, than if no noticeable change occurred. If world prices of the products concerned should move up, retaliation would be less likely than if they should decline, whatever the cause of the shift in level. The greater the early success of the plan in raising prices and stimulating production here, the greater would be the tendency to defensive action abroad.

Many countries that import considerable quantities of our wheat, flour, and other agricultural products, indeed, would find insufficient motive for retaliation.[3] A few, like Great Britain (in the past, if not so clearly in the present), are so deeply committed to free-trade policies, which they are most reluctant to modify, that they would avoid retaliatory action even under great pressure. Others, like Great Britain again, welcome cheap food, even if it appears to injure their own farmers. Many would doubtless hope, with good reason, to share with American farmers the benefit of the policy, by obtaining agricultural imports at lower prices as a result of the operation of the plan. European cities would not resent lower prices for wheat, and countries with large industrial populations would be loath to take measures to

[1] *Congressional Record*, May 1, 1929, p. 742.

[2] *Ibid.*, April 22, 1929, p. 285.

[3] Cf. Senator Simmons' remarks in *Ibid.*, April 30, 1929, pp. 667–68.

prevent reduction in costs of living. Industrial interests and organized labor abroad might well oppose a reprisal policy on the ground that, in so far as the debenture system was effective, it would favor their interests in industrial competition with the United States, by raising American costs of living and production costs, while lowering corresponding costs abroad. Some countries, moreover, would deem the measure no threat to any domestic interest, agrarian or industrial. It is quite possible that the larger part of our flour exports, in particular those which go to ex-European countries with inconsiderable cereal and milling industries, would be unaffected by retaliatory measures. Broadly speaking, anti-bounty and anti-dumping measures have not been extensively applied, even under considerable provocation,[1] except in the special case of imposition of depreciated-currency surtaxes since the Great War; but two reasons for this have been the difficulty of ascertaining the existence of dumping, and the limited resort to production and export bounties in recent years.

It is highly probable, however, that there would be some retaliatory action, not only by importing countries, but by competing exporting countries. It might easily reach considerable dimensions. Germany, France, and Italy are earnestly pursuing policies of agrarian protection, and regard domestic wheat growing with notable solicitude, partly for reasons of national defense. Their wheat and flour tariffs are now very high. If our debenture plan were appraised as a measure tending to lower their domestic wheat prices, it might appear to them natural and appropriate to levy countervailing duties.

The prospect of similar action by Great Britain is by no means to be dismissed. British policy in such matters is subject to notable influence from her leading dominions, which have already secured certain preferences in the British import trade. Canada and Australia are heavily interested in growing and milling wheat, and in exporting wheat and flour. It seems probable that they would see in our debenture policy a government-stimulated competition with their wheat and flour (and other farm products also) in world markets, with consequent injury to their agricultural and export industries. If so, they might well seek to have Great Britain impose countervailing duties, as the form of pressure most likely to limit their injury from the plan in operation. Any British Government would take such a step with reluctance, both for reasons of tradition and for fear of injuring Anglo-American relations. But it would find it more difficult to refuse to act than in the case of sugar bounties; and such action would doubtless be supported by British agrarian interests.

One possible eventuality deserves special mention. Several countries that are net importers of wheat and flour have domestic milling industries. It is the prevailing practice of such countries to impose relatively higher duties on flour than on wheat grain. Some such countries might not yield to agrarian pressure to impose countervailing duties on American wheat, but might impose such duties on American flour. This policy would be disastrous to such flour trade as we have with these countries. Our millers would find the higher domestic price on their wheat offset by debentures on the export of flour, possibly more, but only to meet a special barrier at the customhouses of the importing country. Flour importers would demand price concessions corresponding roughly to the amount of the special duty; and American millers would be hard put to it to grant them. The volume of trade thus affected might not be large in the aggregate, for most of our flour exports go to countries which have no important milling industries; but it is by no means a negligible trade from the standpoint of volume or profits.

Limited or sporadic retaliation could significantly and disadvantageously alter the course of our trade. If Germany should retaliate on flour and pork products but not on cotton, and France and Italy on wheat and flour but not on tobacco and cotton, if Argentina should raise duties on American machinery, and if similar selective discrimination should be put in practice elsewhere, the debenture plan might not be wholly nullified but the limited gains would be bought at appreciable real cost.

[1] Cf. Jacob Viner, *A Memorandum on Dumping* (Submitted to the Preparatory Committee for the International Economic Conference), League of Nations, Geneva, 1926.

Our international relations, commercial and otherwise, would almost certainly be affected adversely.

Even if no direct reprisal resulted, it might happen that lowering of international prices, under the operation and in consequence of the plan, would lead to higher import duties in certain foreign markets. It is worthy of remark that recently Italy, France, and Germany raised their import tariffs on wheat and flour, almost simultaneously with the reduction in export freight rates here and in Canada. Such a reaction, however, would affect us no more than other exporting countries.

With respect to the probability of foreign reprisals, it is well to observe a change in the attitude of the world toward artificial devices affecting international trade. Before the war, when one country proposed an action calculated to influence the trade with another, the diplomatic and legislative reactions were largely in response to the influence of the parties directly interested. Since the war, however, the subject of trade barriers has been raised from a strictly commercial position to one with larger bearings. It is not too much to say that the movement in the direction of lowering trade barriers has assumed almost the position of a political religion in Europe, and efforts in the direction of increasing trade barriers or disturbing trade relations are regarded as menaces to international amity. Under these circumstances, it is more than possible that political action of other countries against such a procedure as the export debenture, while instigated by the directly interested parties, would be supported by classes not directly interested, on broad grounds of economic and political convictions. Under such circumstances, reprisals might be provoked even if they were ill-advised on narrowly economic grounds.

In advance of experience with the debenture plan it is impossible to make accurate predictions as to the extent of foreign retaliation and its reflex influence. Conceivably the reaction would be less than in the case of outright bounties, but it is hard to believe that the thin disguise that the debenture plan would wear would seriously modify such reactions as undisguised bounties would provoke. The reaction could be expected to be much more pronounced than in the case of the dumping of manufactured products, which is difficult to detect and measure. It is quite improbable that the reactions would be so general as independently to defeat the aims of the debenture plan. But it is highly probable that there would be sufficient retaliation to reduce the real benefits below, and probably substantially below, those calculable on the assumption of a benevolent attitude on the part of foreign nations, and to modify the course of trade in ways adverse to American exporters of agricultural and other commodities. It is also hard to believe that the plan would not injure our good-will abroad in ways less tangible but no less important. It would almost unquestionably affect our own international policies. To be consistent, we should have to repeal Section 303 of our tariff law, and modify our expressed attitude toward measures taken abroad, in the interests of producers, that have been construed as contrary to our national interests.

Possible Imitation Abroad

Another type of possible reaction abroad may be mentioned in concluding this section. Agricultural difficulties and agrarian discontent are by no means confined to the United States; they prevail in a great many countries. If the debenture plan is a sound measure of national policy for the United States to adopt, it should be extensively copied abroad. Even if the debenture plan were not really well-advised in our own interest, if we adopted it and continued to prosper under it there would be a tendency to adopt it elsewhere. Unquestionably our example in maintaining highly protectionist tariffs, and our prosperity under them—regardless of whether the prosperity is or is not really due to the tariffs—has been influential toward higher tariffs generally.

Now it is impossible to conceive of the extended adoption of the system without some such results as were experienced with sugar bounties — general overproduction, serious disturbances to industry and trade, heavy cost to national treasuries, and eventual injury to agriculture itself. Whatever advantages it might yield to our farmers if we alone tried it, these benefits would cer-

tainly be reduced or perhaps nullified if it were extensively imitated abroad. Under our present laws our Treasury would have no choice but to impose countervailing duties on foreign products exported under the system, and governments otherwise disinterested would be pressed to meet reprisal with reprisal. An international agreement to end the system would probably be called for.

Here the contrast with Germany's import certificate system is important. It has created no serious complications, at home or abroad, because Germany exports no large volume of any of the products affected, and is a net importer of the group of products to which the system applies. Under it Germany exports more of certain types of grain, from certain regions, than she would otherwise do; and imports from abroad, to other regions of Germany, more of other types. The system tends to remove obstacles to the economic flow and utilization of goods, not to set up new currents uneconomic in character. If we really undertook to apply the German system to farm products of which we are net importers, Germany's satisfactory experience with it might be duplicated here. But in the proposed conditions of its application, the debenture plan is a horse of entirely different color.

It may well be that we can afford, far more easily than most nations, to make costly experiments in the effort to improve the status of farmers. Surely, however, it is sounder policy to make such experiments as would promise, if they succeed, to be applicable elsewhere without reacting adversely upon us. We are entering upon such an experiment with our federal farm board under the Agricultural Marketing Act. Reasonably applied, it should injure none but ourselves if it fails; and if it succeeds it should be constructively helpful abroad as well, without creating international complications or becoming self-defeating by the operation of economic and political forces.

VI. CONCLUDING CONSIDERATIONS

Before bringing our analysis to a close, we must mention briefly two other aspects of the appraisal of the debenture plan, its relation to surplus control and to so-called price stabilization.

The Plan as Surplus Control

The debenture plan has been urged as a measure of surplus control. Mr. L. J. Taber, Master of the National Grange, said recently before the Senate Committee:[1]

> It will help eliminate the surplus.
>
> . . . . . .
>
> . . . . The reason that I am emphasizing the export debenture is that we believe it is so certain to work, that its simplicity, its dependability make it the step to enable the farm board to deal with the surplus problem.

As a surplus control measure it is clearly of limited scope. It is intended to apply only to farm products of which the surplus is of the exportable variety. It would have no bearing on price-depressing "economic surpluses" which are not readily susceptible of relief by exportation, as in the cases of hay, potatoes, perishable fruits and vegetables, and many others. These crops would continue to demand surplus control, and it seems not unreasonable to suppose that methods that would serve this purpose could be adapted to those products that we export in substantial amounts.

In a special sense only is it a surplus control plan. It is designed to prevent exportable surpluses, as they exist at a given time, from exerting their usual influence upon domestic prices. This influence would persist, but it would operate under conditions causing a substantial differential to arise between domestic and export prices, in favor of domestic prices. The action might better be designated as surplus-consequence-influencing, rather than surplus-controlling. Much the same could be said of the equalization fee plan, although this called for more centralized handling of the surplus.

In a larger sense, however, the debenture plan is definitely not a surplus control measure. It calls for no measures to deal directly with an existing surplus. It would apply alike in years when exportable sur-

[1] *Hearings*, April 3, 1929, pp. 514–15.

pluses were large and when they were small, when they did not lead to price depression as in years when they did. It would operate in the direction of increasing exportable surpluses of the commodities to which it was applied, such as wheat and cotton, thus tending to enlarge the surplus problem rather than alleviating or curing it. Consequently, it would intensify rather than lessen the need for measures to restrain the tendency to such overproduction as leads to unremunerative prices. Moreover, so far as the agricultural surpluses constitute a world problem, the plan would merely relieve our producers of some of the consequences of general overproduction, initially, but intensify the world problem, both immediately and through subsequent expansion of our production and exports, even if our policy were not imitated abroad.

If we really seek surplus control, we should adopt measures calculated to restrain the emergence of such surpluses as tend to bring prices down to levels unremunerative to producers, and operative procedures designed to dispose of these "economic surpluses" in such ways as could be generally adopted with success, in various products at home and among the agricultural nations. The debenture plan does not represent a measure of this type. Though its adoption would not render impossible other measures of this character, it would render their task more difficult rather than easier.

Relation to Price Stabilization

The instability of farm prices, within a year and from year to year, is one of the evils which certain measures of farm relief are designed to alleviate if not to cure. The debenture plan is not designed to contribute to this end, but it is not generally realized that in practice it could be expected to accentuate the evil.

Upon the reasoning most commonly employed, the debenture system would not affect the instability of prices; it would merely elevate prices; differentials between domestic and export prices would be attained and maintained, but intraseasonal and interseasonal variations in prices would be unaffected. If the system were applied to a large group of commodities, which was neither expanded nor contracted; if rates were held constant; if it failed to stimulate production—this reasoning would probably apply, and the system would neither increase nor decrease the instability of prices, after it had been fully put in force.

In fact, however, these conditions would not obtain. Even the ardent supporters of the plan realize that it contains possibilities of stimulating production, and they have, as we have seen, accepted one or another scheme of flexible rates as a means of restraint upon this tendency. Even the earlier bills contained provisions for expansion of the list of debenturable products, and for changes in rates by administrative action, while the latest bill vests still greater responsibilities in the directing agency.

It is quite clear that the initial effect of putting a commodity on the debenturable list, or of increasing a debenture rate, would introduce a special element of instability in prices, affecting not merely the commodity itself but others that were more or less closely related to it. The same would be true, in a different direction, of reductions in rates or removal of a commodity from the list. One can conceive of the adjustment of rates as being applied with the purpose of minimizing price variations from year to year. But no one has proposed that this be done, and it would almost certainly run counter to the real objective of the plan, price elevation. Moreover, the possibility of changes in the list or in rates would introduce a special element making for price instability.

It is no defense of the plan to argue that the same point can be made against changes in tariff duties. Admittedly this is one of the inescapable evils connected with tariff alterations. But the application of the debenture plan to commodities of which we produce huge surpluses, on an annual basis, might easily be more far-reaching in this respect, because of the relatively large volume of stocks held and the more widespread operation of dealings in futures. One of the points in favor of the debenture plan, in the view of many, is that it would not interfere with business,

with established trade processes and practices. In large measure this might be true if the system were a settled one, but it would be far from true if the system were subject to repeated alteration by Congress and its administrative agencies. The disturbance to business frequently associated with tariff revision might well be exceeded by the disturbance caused to the business interests directly concerned in such frequent alterations of the debenture system as are in contemplation.

Furthermore, the provision for adjustments of debenture rates according to schedules of output would operate, if the schedule were so constructed as to be effective in checking a stimulus to production, in a manner conducive to price instability. Suppose a bumper crop harvested as the result of good yields on a large acreage. A substantial reduction in the debenture rate would be made at the very time when the surplus was largest, the world price presumably lowest, and the farmers presumably most in need of protection against price decline. If the schedule were allowed to operate, against the protests from farmers that in their direst need their protection was reduced, the price would fall farther than if the system had not been applied. Perhaps in the very next year production might fall so that the normal debenture rate would apply. Then there would be an added factor making for price advances.

We do not overlook the fact that other measures might be attempted, with no opposition from devotees of the debenture plan, to moderate fluctuations in prices. It is not inconceivable that by such measures the instability in prices might be lessened even if the debenture system were in effect. But we cannot escape the inference that the debenture plan per se would heighten, not lessen, the variations in prices, and that it would intensify the large difficulties that any stabilization program must needs encounter.

It is conceivable that a restricted form of the debenture plan might possibly be found helpful in limiting extreme depressions of prices, and thus of some utility in lessening price variations. Here the analogy of the British corn bounties is most directly in point. It will be recalled that these were payable only when prices of the grains in question fell below stated levels. Suppose for example, that a schedule were drawn up in accordance with which export debentures at the rate of 20 cents a bushel were issuable if Chicago futures prices, reflecting Liverpool prices, fell for a week below $1.05 a bushel, at 15 cents if they ranged between $1.05 and $1.10, at 10 cents if they ranged between $1.10 and $1.15, and at 5 cents if they ranged from $1.15 to $1.20; but that no debentures would be issuable when the Chicago future ranged above $1.20. If such a scheme were found practicable, it might yield support to the market when prices fell below certain levels, and tend in the direction of restricting price variations. Whether it would be superior or inferior to alternative means for accomplishing the same result, under machinery about to be set up, cannot be forecast. But it would be a very different scheme from the proposed debenture plan, and would be far less likely to provoke retaliation abroad.

Conclusions

In summarizing the results of our analysis of the export debenture plan, with special reference to wheat, we would repeat that it represents an attempt to predict the unpredictable; but so, of course, does the reasoning of proponents of the plan. Even a retrospective examination of the workings of the system would encounter insuperable difficulties in disentangling, from the facts as they appeared, the effects properly to be ascribed to the debenture policy. We have tried to take into account all the theory, reasoning, and evidence brought forward on behalf of the plan, and a good deal more equally worthy of attention, as regards its probable operation. We have sought to interpret the whole with fairness and insight. We have not been content to point out possibilities, for good or ill, but have endeavored to weigh the probabilities without bias.

The true value of the plan must be judged not by its theoretical justice or appropriateness, but by its practical virtues—gross and net. The investigation leads us to the conclusion that these virtues have

been gravely, however unintentionally, misrepresented. In our considered judgment, the plan would fail in practice to yield the promised advantages. No one can foretell how well or how badly it would work, but it seems to us safe to say that at best it could not be expected to yield more than a portion, and possibly only a small fraction, of the benefits that are claimed for it, and this at the cost of numerous complications.

At the outset, the scheme would raise farm prices of wheat, but not by the full extent of the debenture rate. Even if there were no expansion of output and no foreign retaliation, the extent of price increase properly attributable to the operation of the plan would vary with different wheats, in different regions, and from year to year. There are strong reasons for rejecting, even as respects the first year or two, the view that farm prices would be promptly, uniformly, and generally raised by the amount of the debenture rate. The price benefits actually realized by farmers would probably be much less, and would be very unequally distributed, geographically and locally. Some who are most in need of relief might gain least.

The tendency of continued operation would be to stimulate production and export, particularly of those wheats which otherwise tend to be on an export basis because least in demand here. There is ample scope for response to such stimulus, if the plan were applied generally, and even more if it were limited to wheat, or to wheat and a few products that did not compete for the same land. The result of our increased exports would be to depress world wheat prices below what they would otherwise have been. In our view, it is likely that this process would go so far, within three or four years, as largely to wipe out the initial price advantage to farmers. These results would not be equally distributed: some farmers would continue net gainers; others would probably be net losers; but the aggregate net gain would probably be slight.

If the plan were simply continued, these results would lead to readjustments in acreage, both here and abroad. A new equilibrium would then be reached in which, perhaps in the second half of a decade, our wheat growers would reap a somewhat larger net gain than in the intermediate stage, though considerably less than at the outset. If foreign acreage were highly price-responsive, less readjustment would be required here and the eventual net gain to American wheat growers would be larger than we are disposed to expect; but we question whether such readjustments, in the countries most significant in determining world prices, would be of sufficient magnitude to alter our conclusions substantially.

Efforts to increase the gains by raising debenture rates might succeed, in a measure, but the repetition of the process would tend shortly to nullify these gains, at least in considerable part. The plan would not be self-eliminating, but self-perpetuating, unless radical schedules of reduction in rates with expansion of production were put in force. Such an operation, with price declines accentuated thereby, would doubtless check expansion and probably cause contraction from the expanded level, but only at a cost of material readjustment and by eliminating most or all of the advantages claimed for the debenture policy. The abandonment of the system, if brought about by rising costs to the Treasury and disappointment with its contribution to farm prosperity, would entail greater pains of readjustment in agriculture and greater disturbance to business interests concerned.

So far as foreign experience is really pertinent, it seems to us to confirm such an analysis, rather than to support the theory of advocates of the plan. The experience of Germany and other nations with import certificates, a device similar to the proposed export debentures, is not truly applicable because that system has been and is applied under radically different conditions and with quite different objectives. England's experience with grain export bounties was had under quite dissimilar conditions and is obscured in the mists of history; but so far as we can discern from the literature, it yields nothing materially inconsistent with our view of the working of the proposed debenture plan. The more recent experience with sugar bounties in continental Europe tends to bear out our reasoning more emphatically, and particu-

larly reveals the possibility of international complications and grave disturbances to industry and trade without offsetting benefits to agriculture.

The possibilities of retaliatory action by foreign governments are large, and our own law and practice would require such resistance on the part of the United States to foreign measures of the type of the debenture plan. While we should not expect these possibilities to be realized at all completely, we see good reason to expect sufficient resistance and retaliation to cause substantial diminution in the anticipated benefits to American farmers, appreciable alteration in the course of trade, and significant international complications.

In the light of this analysis we feel it unnecessary to consider at length all of the arguments that have been brought forward for and against the plan. But it is perhaps worth while to touch very briefly upon a few. Though we regard the prejudice against subsidies as generally wholesome, and recognize that there are points of similarity between the debenture plan and a subsidy, we do not consider serious, or notably well founded, the argument that the scheme should be rejected because it would subsidize agriculture. The term is not appropriate, and various other proposals are open to very much the same objection. The necessity for raising additional public revenues to replace the customs receipts absorbed by the plan is not a material objection under present conditions, provided the plan would really work as its advocates expect; but it would become serious if the plan proved to cost the Treasury heavily without genuine benefit to agriculture.

In the light of our own analysis, we believe that costs to consumers (as well as benefits to farmers) would be much less than those that have been calculated, on any given scale of debenture rates; and we agree that moderate increases in the prices of several agricultural products could be easily tolerated. We frankly regard all the calculations of burden to the Treasury, cost to the public, and financial benefits to the farmer as thoroughly unreliable if treated as forecasts; for neither the list of debenturable products, nor the exports of these, nor the debenture rates, nor the reflex effect upon farmer prices or consumer prices, can be predicted. We should expect, if the plan were applied rather comprehensively, that the cost to the Treasury would be greater, while costs to consumers and benefits to farmers would be less, than has usually been calculated; and that with continued operation of the plan these differences would be accentuated. We believe the plan would not present administrative problems and difficulties nearly as large and numerous as would several alternative plans, but in the light of our analysis we feel certain that experience would show that its advocates have greatly overestimated its simplicity.

We believe the adoption of the plan would be, in effect, a radical innovation in our national policy, in spite of a large measure of truth in analogies to the protective tariff. Yet we would not condemn it on this score. Our Federal Reserve Act, the national prohibition amendment, the Agricultural Marketing Act, and many other acts have represented radical innovations. Some have worked well. On the other hand, we consider that it is improper and unsafe to regard it as a simple experiment, deserving a trial merely because it has been widely urged, with a view to dropping it if it does not yield desired results. It is too important a proposal, with too far-reaching possibilities of cost and disadvantage, to be light-heartedly adopted. Even if initially experimented with on a limited scale, the difficulty of disentangling the results of the trial, and the possibilities of fastening upon the country a far more extensive and prolonged experiment, would be serious.

The argument that it would necessitate revision of import tariffs is doubtless sound so far as it goes, but of no great moment except as increasing the number of complications, and of no great importance as regards wheat and flour. We do not regard it as a sound argument for the plan that it would strengthen the position of the whole protective tariff. If it did this it would, in our judgment, be to the detriment of the farming class, who probably suffer some net injury from our tariff system as it has been and as it is likely to be under practical modification in the direction of higher du-

ties. Nor do we share the cynical view that it might be well to try out the debenture plan in the hope of bringing the tariff into disrepute, or of forcing tariff readjustments in favor of the farmer. Logical as the argument appears that it is a natural complement of the protective tariff, we believe that the plan would not prove to be such in fact.

We cannot go so far as to assert, with President Hoover, that the plan "contains elements which would bring American agriculture to disaster." On the other hand, and in part for the same reasons that lead us to a more moderate view of its dangers, we see no possibility that it would yield "equality for agriculture." Perhaps its largest fruit would be bitter disappointment. The direct and indirect costs of the plan itself, particularly in view of the difficulty of retracing the step, would not be unimportant; but the delay caused by moving along the wrong road would be more serious in reality. We believe the plan is not truly harmonious with the new measure of farm relief, or with the types of remedial and constructive policy that the federal farm board will do well to adopt to supplement the marketing reorganization that now appears to be its major task. If one could assume that the board could freely exercise its discretion as to using or ignoring a power that might be given it to apply the debenture plan, one might not object so much to such a grant of power; but this assumption is hardly tenable. There is a real danger that if enacted even in an optional form, it might, as President Hoover thought inevitable, "confuse and minimize the much more far-reaching plan for farm relief. . . . ."

Finally, we hold that, now that the federal farm board has been established, it should lie within the scope of the board's functions to consider fairly, with the aid of a competent research staff, all plausible suggestions for developments in our agricultural policy. The debenture plan, or some variant or modification of it, may have more genuine merit than our analysis has disclosed. There may possibly be devised some method of experimentation with it that would yield fruitful net results. If, after due investigation, the board should propose such an addition to its powers and duties, its recommendation would deserve great weight; or if Congress should, on its own initiative, adopt the debenture plan in some form bearing the endorsement of the board after such study, the situation would be altered. But we are convinced that, with all deference to the intelligence and sincerity of proponents of the plan, the reasoning behind it is not only inadequate but leads to erroneous conclusions. For Congress to put the debenture plan into law, at the present juncture, would be a mistake. We venture to believe that many of those, in Congress and outside, who have been disposed to support the plan will modify their views with fuller knowledge and upon maturer consideration.

This study is the work of Joseph S. Davis, with the aid of criticisms and suggestions from Alonzo E. Taylor, Holbrook Working, L. B. Zapoleon, and M. K. Bennett. Generous and friendly comments on an earlier manuscript on the debenture plan, received from its chief proponent, Charles L. Stewart, were helpful also in this one.

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WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 9 AUGUST 1929

WHEAT UNDER THE AGRICULTURAL MARKETING ACT

SOME PROBLEMS OF THE FEDERAL FARM BOARD

THE Agricultural Marketing Act constitutes an innovation in national policy. It embodies recognition of the desirability of maintaining reasonably comparable progress in agriculture and industry. Since the beginning of the century, and especially since the war, urban industry as a whole has undergone reorganization, through scientific management, from which rationalization of production methods has resulted. The outstanding problem facing urban industry today is to introduce into the system of distribution an efficiency comparable to that existing in the methods of manufacture. Reorganization of distribution is believed to lie within the powers of industry. Agriculture, like industry, has undergone extensive reorganization on the side of production, and as a whole agriculture is probably as efficient in production as is urban industry. The system of distribution of agricultural products remains inefficient. The new legislation is addressed to this situation. It is based on the view that agriculture is so far-flung and contains so many units that reorganization from within is peculiarly difficult and is therefore entitled to governmental assistance.

The new legislation does not deal with an emergency and is not designed as an operation of salvage. It is a forward-looking measure, designed for the permanent betterment of agriculture. In the Agricultural Marketing Act are envisaged a reorganization of co-operative marketing and a rationalization of the processes of distribution. Wheat is one of the most important crops and is prominent in our export trade. Wheat growers have suffered both general and special disabilities. On the basis of existing information, it ought to be possible to make a tentative appraisal of the reorganization of wheat production and trade under the Act. We undertake such an appraisal in the ensuing study.

STANFORD UNIVERSITY, CALIFORNIA

August 1929

WHEAT STUDIES

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FOOD RESEARCH INSTITUTE

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Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912. Published by Stanford University for the Food Research Institute.

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WHEAT UNDER THE AGRICULTURAL MARKETING ACT

SOME PROBLEMS OF THE FEDERAL FARM BOARD

INTRODUCTION

The Agricultural Marketing Act of 1929 represents an innovation in national policy. Apart from the creation of a new agency with broad powers, the most prominent features relate to the reorganization of the marketing of farm products, under the new Farm Board, in order "to protect, control, and stabilize the currents of interstate and foreign commerce in the marketing of agricultural commodities and their food products...." The theory of the Act is that such a reorganization, among other things, is requisite "so that the industry of agriculture will be placed on a basis of economic equality with other industries." When one considers the privileges and exemptions enjoyed by agriculture under the farm loan act, the intermediate credit act, and the Capper-Volstead act, it becomes abundantly clear, as stated by the President in his initial statement to the Federal Farm Board, that the Agricultural Marketing Act invests the Board "with responsibility, authority and resources such as have never before been conferred by our government in assistance to any industry."

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The Agricultural Marketing Act is the outcome of an intensive struggle of eight years' duration. That the Act is largely permissive rather than mandatory is due in part to the circumstances out of which it has grown. More than appears in the Act, it represents one side of a fundamental cleavage of opinion. The Agricultural Marketing Act contemplates the systematic reorganization and rationalization of the distribution, i.e., the marketing, of agricultural products. The equalization fee and the debenture plans contemplated the differential enhancement of the domestic price level of agricultural products, without reorganization and rationalization of distribution. It is true that the proponents of the equalization fee and of the export debenture did not oppose co-operative marketing and were nominally in favor of it; but, in their view, co-operative marketing was not necessary to the success of the equalization fee and the export debenture in effecting amelioration of agricultural distress through the predicated differential enhancement of the domestic price level. Since the passage of the new law, prominent proponents of the equalization fee and the export debenture still hold the view that it does not lie in reorganization and rationalization of distribution to effect the amelioration of agricultural distress as they define it. Since comparable precedents are lacking in reorganization and rationalization of distribution of farm products, the Agricultural Marketing Act represents an experiment, to which the country is now committed, in the positive outcome of which the supporters of the measure have high confidence. Therefore, for both wings of opinion, the policy of reorganization and rationalization of distribution of agricultural products is on trial. Under such circumstances, objective appraisal of developments will be greatly facilitated by a clarification of terms and, so far as possible, agreement on assumptions, since every forecast of an economic nature must rest to some extent upon postulates.

We venture to apply the word "rationalization" to distribution in analogy with the application of the term to manufacture. Rationalization of manufacture means mass production under scientific management. Rationalization of distribution means mass marketing under scientific management. In the first case it is related to the spread between raw materials and finished goods; in the second case it is related to the spread between producer and consumer. The investigations into the wastes in distribution now being conducted under the auspices of the Department of Commerce are designed to lead to a rationalization of distribution. We take it that a corresponding development is implied in the Agricultural Marketing Act.

The concept and present definition of rationalized marketing, the extent to which this is to be applied, the number of agricultural products to be subjected to the procedure, and the administrative methods to be employed will be determined by the Farm Board. For many farm products the questions are of international significance, and much of economic theory and trade practice is involved. Under these circumstances, and in view of the magnitude of interests involved, careful reasoning on the premises is imperatively necessary. "Our general answer to farm problems," said Secretary of Agriculture Arthur M. Hyde, "is organization—organization to control marketing, to standardize output, to eliminate the waste and duplication of a marketing and distributing system which, generally speaking, absorbs two dollars for every one dollar it returns to the farmer."[1]

Broadly speaking, the means proposed to be adopted center upon the substantial encouragement of farmers' co-operative marketing associations, to the point of elevating them to a position of major importance in the marketing of farm products. Contemplated also is the formation of commodity "stabilization corporations" resting upon the co-operatives and performing, with the aid of funds advanced by the Treasury under regulations established by the Farm Board, functions which the co-operatives find themselves unable effectively to perform. The terms "stabilization" and "price stabilization" have figured largely in the discussion; but it is clear that "stabilization" is conceived in a loose sense, without consistent reference either to acreage, price, income, rate of marketing, or anything else. Certainly price stabilization in the sense of maintaining a horizontal course of prices through a year and from year to year is not a primary objective. The fundamental objective is to increase the remunerativeness of farming, not by direct price-raising measures as proposed under the equalization fee and export debenture plans, but by a combination of measures designed to secure merchandising economies, to moderate price fluctuations, to reflect back to the growers a greater proportion of the value of their product, and to influence production with a view to minimizing growers' losses and enhancing growers' returns.

The intent of the Congress is to be taken from the wording of the Act. A careful perusal of its language indicates clearly that, within the broad powers conferred upon the Farm Board, considerations of marketing take precedence over direct price-influencing procedures. In other words, merchandising is primary; stabilization and elevation of price are secondary. This general inference from a perusal of the Act seems to us reinforced in the concluding paragraph, "This Act may be cited as the 'Agricultural Marketing Act.'"

The proposed reorganization of marketing will represent a gigantic innovation, a series of large experiments, since the problems vary with the products. The interests involved are of great magnitude. Presumably the Farm Board, to which is entrusted the inauguration and direction of the enterprise, will not undertake to apply it to many products at the outset. To a large extent the Board is empowered to determine the products to be subjected to the procedure, and the set-up and administrative procedures to be employed. But it will certainly be under heavy pressure to put in operation the new machinery and procedures as generally and as promptly as possible, though there will be much counter-pressure.

Wheat is one of the major crops to which

[1] From a radio address of the Secretary introducing the Department of Agriculture's period in National Farm and Home Hour, delivered July 8, 1929.

the proposed measures are designed to be applied. We have therefore undertaken in this study to discuss in advance some of the important problems that will confront the Farm Board and its agencies in dealing with the commodity wheat.

I. SCOPE AND LIMITS OF "STABILIZATION"

Attitude of the Wheat Grower

At the outset, it is pertinent to mention briefly certain elements in the financial situation of American wheat growers. Like other farmers, they have experienced an extensive decline in prices of farm lands from the peak in 1920. Among wheat farmers are many whose indebtedness, on mortgage security and otherwise, rose to high levels during and immediately after the war, and has shrunk but little in subsequent years. Not a few have lost their farms, and many others are struggling under a heavy burden of debt. Taxes are high and there seems slight prospect of recession. Net returns from wheat growing have varied in different years, in different sections, and even among individual farmers in the same section and in a given year; but by and large current returns have not been regarded as sufficiently remunerative to enable the growers to maintain standards of living which they insistently desire. The causes of the situation are numerous and complex, and need not be discussed here; but it is in the hope of improving the net returns from wheat growing that the proposed measures would be applied to wheat.

There are thus several different factors in the dissatisfaction of wheat growers with their returns: wheat prices, operative costs, fixed charges, purchasing power of net income, and increased wants. In particular, however, there is disaffection with wheat prices on four main grounds.

First, wheat growers complain that not only in occasional seasons but over a period of years the level of wheat prices has been too low—judged either by terminal prices, farm prices, or gross returns per acre. Various sets of data have been produced to support this complaint.

Second, wheat growers feel that the spread, or margin, between farm prices and terminal prices is too wide, and this entirely apart from the increase in freight rates. This is a part of the general complaint that the spread between producers' prices of raw materials and consumers' prices of finished goods has become too wide. This broad view found expression in the statement of Secretary of Agriculture Jardine in his annual report for 1928, that an outstanding objective of farm relief is to secure for the farmer a larger proportion of the consumer's dollar. Within Congress, and without, exists the widespread notion that it ought to be possible substantially to increase the grower's price of wheat without raising the prices of wheaten products to ultimate consumers. In the case of wheat there are two parts of the spread between producer and consumer: the margin between farm selling price and purchasing price at mill (and port of export) and the margin between purchasing price at mill and retail price of flour and bread. With the latter we are not here concerned. Protest against the margin between farm selling price and mill buying price resolves itself into the contention that the cost of merchandising and distributing wheat is excessive.

Third, wheat growers hold that farm prices of wheat, as of the grade, do not adequately reflect the milling values of wheats, that grading at country points is to some extent often discriminatory, and that the mixing of wheats in terminals creates commercial values that do not accrue to growers. In short, the weighted grade of wheat bought by millers and exporters is believed to be higher than the weighted grade of wheat for which farmers are paid, so that the premiums paid by millers for protein and other qualities accrue only in part to growers but instead largely to distributors.

Fourth, wheat growers believe, or fear, that fluctuations and variations in wheat prices on the grain exchanges have the net effect of lowering the weighted farm price of wheat. Speculation is suspected of price-depressing tendencies. In particular, it is urged that short selling of wheat futures coincident with heavy marketing of wheat after the harvest, depresses the price at a

time when two-thirds of the crop leaves the hands of the grower.

We do not propose here to analyze these several elements in the wheat growers' bill of complaint. Clearly, however, it has contributed toward the enactment of farm relief legislation and influenced the form of the Agricultural Marketing Act; and it will have to be reckoned with by the Federal Farm Board.

So far as the reorganization of wheat marketing is concerned, it must presumably aid wheat growers chiefly in connection with what farmers receive for their wheat. The agencies operating under the Farm Board would presumably seek to narrow the margin between terminal prices and farm prices for the benefit of the farmer; to reflect back to the grower the full value of the wheat he produced; and to moderate fluctuations in wheat prices within a season and from year to year.

Meaning of Price Stabilization

So much has been made of the term "stabilization" that it is desirable to examine with some care the significance of the term in the present connection, and in particular to consider the scope and limits of wheat price stabilization. In our view, the use of the term "stabilization" in the Act will come to be recognized as unfortunate. Stabilization of the general price level, "stable money," is a large monetary problem. As used in the Act, the term has been drawn not from the nomenclature of economics, nor from the terminology of the trade, but has been borrowed from current political discussions.

Unlike the terms "subsidy" and "dumping," which have a displeasing connotation, the term "stabilization," like "justice for the farmer," "equality for agriculture," and "orderly marketing," has a pleasing sound; but like these latter terms, it is not very specific in meaning. It implies the smoothing out of irregularities and fluctuations. But when one considers stabilizations (*a*) of wheat acreage or production, (*b*) of the flow of wheat to market or to export, (*c*) of wheat prices, or (*d*) of wheat growers' returns, one is at once confronted with questions as to the degree to which these would be feasible, and to their desirability in so far as they are feasible. Indeed, the impracticability of stabilizing all of these at once is easily demonstrable. Even the acreage planted to wheat cannot be stabilized, much less the harvested acreage. Even if this were possible, wheat production could not be stabilized, because of unpreventable variations in abandonment of acreage and in yield per acre. "Orderly" marketing, conceived as the maintenance of a regular flow of wheat from farm to market, from month to month, might be put into effect; but one could hardly expect that this would diminish the instability of wheat prices. The instability of terminal wheat prices could be reduced, though not eliminated; but this would not stabilize returns to wheat growers, and it would not necessarily increase the average net return. In short, the virtues of "stabilization," strictly construed, are unduly extolled in common parlance.

Nevertheless, it is entirely within the bounds of truth to assert that abnormal and costly fluctuations occur in wheat acreage, production, marketing, prices, and growers' returns. While stabilization suggests an impracticable ideal, and while the costs as well as the gains from approaching this ideal require careful consideration, there is good reason to hold that some measures to reduce instability would yield a net advantage. It may be taken for granted that a Farm Board would view the matter in this light.

Stabilization as an Objective

The Farm Board would have to determine which of several objectives it would regard as paramount. The advocates of the equalization fee and export debenture—and the more recently advocated domestic-allotment plans—have made elevation of the wheat price level (and the elevation of the domestic wheat price level above the world wheat price level) the paramount objective, on the assumption that this alone would rehabilitate farm net returns. None of these plans promises much, if anything, in the way of price stabilization; indeed, they would probably tend to increase the instability of price.[1] Price stabilization as

[1] Cf. "The Export Debenture Plan for Wheat," Wheat Studies, July 1929, V, 342–43.

a paramount objective, whether within a year or from year to year, would not clearly enhance growers' returns to any large extent. We take it that the view behind the present Agricultural Marketing Act is that improvement of wheat growers' net returns over a period of years should be the paramount objective, and that measures of direct price elevation and planned price stabilization should be subordinated. From a practical standpoint, this would seem to be soundest policy; but it will impose a heavier responsibility upon the Farm Board, for the test of its success will not be the achievement of the initial objectives of price elevation or price stabilization, but the achievement of the ultimate goal of such proximate objectives, the improvement of the farmers' real position.

Whatever the concept and definition of stabilization to be employed, there is a short-term and a long-term view. The short-term view corresponds to stabilization within the crop year, the long-term view implies stabilization from year to year over a period of years. This distinction is not sufficiently appreciated; and it is important, since it is not to be taken for granted that measures of stabilization applicable within the crop year would, if repeated year after year, automatically result in stabilization over the period.

Regarded from the standpoint of existing practices in the grain trade, price stabilization—strictly construed and not including the definitive objective of raising the wheat price level—would concern itself with a series of limited objectives.[1]

1. It would seek to facilitate the transition from one crop year to the next.

2. It would seek to moderate the post-harvest decline in price, without disturbing subsequently the recurring seasonal price advance.

3. It would seek to moderate short-term price fluctuations and eliminate the occasional sharp recessions due to extraneous influences.

4. It would seek to "feed out" the desirable milling wheats, and thus secure the best values for the available wheat.

5. Lastly, it would seek to moderate the year-to-year price variations.

[1] Cf. "Variations in Wheat Prices," Wheat Studies, June 1929, V, 241–300.

Successfully executed, such a program of stabilization might somewhat improve the weighted farm price of wheat and thus incidentally elevate the wheat price without, however, independently raising the wheat price level, i.e., the range of wheat prices. Stabilization, in a somewhat broader sense, implies making the best use and taking the best advantage of the varying relations of supply and demand in a wheat-exporting country where wheat prices are influenced also by relations of supply and demand in the world, with the aid of a governmental revolving fund and the employment of centralized and co-ordinated tactics in wheat merchandising.

Apart from the improvement in farm price which wheat growers expect to accrue as a result of the operations in price stabilization as thus defined, wheat growers anticipate additional profits through the handling of wheat by the co-operative associations operating under the stabilization corporation. They expect to obtain profits from the handling and mixing of wheats and from the merchandising of premium wheats. They hope for a lessening of current losses on the sale of export wheats, whether by co-operative association or stabilization corporation. They expect a narrowing of the spread between farm price and mill price, to their advantage. Thus the increments expected to accrue to wheat growers would represent a combination of the advantages of co-operative marketing with the advantages of centralized merchandising by a stabilization corporation standing above the co-operative associations. "Stabilization" is frequently used loosely to cover all these things, but it is an illegitimate extension of the use of the term. They are better regarded as complementary parts of a trade program.

Limits of Price Stabilization

It is important clearly to recognize certain ranges within which price stabilization can conceivably be achieved, and the limits of what it might accomplish. What the wheat grower would really like is a stablization of his wheat returns per acre at a remunerative level. The most that a price stabilization policy proper could be expected to achieve in this direction would be

a substantial moderation of the fluctuations in terminal market prices, particularly for the grades deliverable on contract without discount or for the average of all marketed grades and qualities. Between these two objectives lies a zone of instability that can hardly be eliminated by any new tactics that may be found practicable, though it may conceivably be restricted by tactics other than those directed at price stablization itself.

In the first place, the individual wheat grower's yield per acre sown varies from year to year. The amount of abandonment of fall-sown acreage in the United States varies on individual farms anywhere from 0 to 100 per cent, and has varied from 1.1 to 28.9 per cent of all fall-sown acreage. The yield per harvested acre varies within relatively wide limits.[1] These variations depend mainly on the characteristics of the season, but partly on other factors—the skill or fortune with which the weather conditions are met, by choice of seed types, preparation of the soil, time of sowing, prevalence of infestations, time of harvesting, and harvesting and storage operations. The same factors, together with the preparations of the soil, determine the quality as well as the quantity of the wheat which the grower obtains per acre. For an individual wheat grower the yield per acre sown, considering both quantity and quality, is a factor that varies more than the average terminal price of wheat. The stabilization of wheat prices per se can have no influence upon the stabilization of wheat yields, and therefore can have only a partial influence toward stabilization of the income of the individual wheat grower.

Stabilization of wheat yields is beyond hope of accomplishment, because weather factors are so complex and variable. A substantial reduction in the prevailing instability of yields is, however, not beyond the bounds of possibility. Several lines of improvement are possible, with a view to reducing the frequency of occurrence of crop failure or damage, or of low quality of wheat. The choice of types of seed, methods of preparation of the soil, types of cultivation before seeding, time of sowing, and times and methods of harvesting, best adapted to the climate and commonly recurring weather conditions, can be considerably improved. Infestations are in part controllable.[2] The level of skill in management of wheat growing can be substantially raised. Agencies long established are active in these directions. Wheat improvement associations are at work in all regions. It is probable that the adoption of a stabilization policy might lead to strengthening these efforts, and they could properly be stressed by a Farm Board; but such endeavors would be supplementary to, rather than an integral part of, a policy of price stabilization.

Another conceivable type of effort directed toward reducing the instability of the returns of the individual wheat grower lies also outside the scope of price stabilization procedures, but might be an appropriate supplement thereto. Granted that the individual grower must expect his crop yields per acre to be variable, it is possible that a system of insurance might be devised whereby the grower might be assured of recouping his actual outlays even if his crop yield is not sufficient to cover them. Separate hazards such as winterkilling, damage from hail, late frosts, tornadoes, and certain pests, might perhaps be separately covered. Much could be gained by the development and application of this type of calamity insurance against the irreducible risks of the wheat grower. It is an object deserving assiduous study on the part of a Farm Board, and it might well prove to be a field in which government funds could wisely be employed, at least in the necessary period of accumulating actuarial data and experience in methods of application, for reinsurance of insurance written by private companies under the supervision of the Farm Board.

The returns of the individual wheat growers also vary not merely with the level of wheat prices, but with the prices of the types, varieties, grades, and qualities of the wheat he produces. Within considerable limits the grading and quality of his product must be expected to vary from year to year. Hence even if prices of particular grades and qualities were stabilized, his returns

[1] Between 1909 and 1928, the widest variation in yield per planted acre was 25 per cent of the average yield of the period. See Table 2 (p. 362).

[2] Infestations are in large part directly or indirectly influenced by climatic factors, though in some instances (e.g., smut) are under the grower's control.

would vary not merely with his quantitative yield, but with the classification his crop received.

Moreover, it is not to be expected that a stabilization agency could prevent the fluctuations in all grades and qualities, especially those that arise between one year and another. In one crop premium wheats may be abundant, in another crop they may be in scant supply. The discount wheats may be more or less abundant. Protein content may run high or low, of good quality or poor. We have elsewhere emphasized the fact that the wheat price structure is complex, even in individual terminal markets.[1] Wheat is not a homogeneous commodity. Each crop contains a wide range of qualities, and the valuations placed upon these different qualities are highly divergent. Modern tendencies in milling and baking practice have led to a sharp discrimination between qualities, especially in respect to quantity and quality of protein content, and to greater diversity in valuations according to quality. Millers in particular have been forced to adapt their buying and milling procedures to make the best of these conditions.

It is hardly conceivable that a policy of stabilization would be applied in ignorance or in disregard of these conditions, or that it would lead either to treating all wheats as if they were identical or to mixing them to get a general average of the crop. To preserve appropriate differentiations for qualities and thus to facilitate rather than to impede milling operations, would be a primary desideratum. Yet such a procedure would have two implications: first, that the task of stabilization would be more complicated than if the wheat price structure were simple or could readily be highly simplified; second, that certain elements of price instability would persist in spite of the best efforts. Thus even if the average price of wheat, or the prices of the grades deliverable on contracts without discount, could be absolutely stabilized, there would persist considerable price variations at least from one crop year to another, as the amounts and proportions of the different qualities varied. Since individual farmers produce wheats whose grades and qualities vary from year to year, the stabilization of terminal prices would not stabilize the per bushel prices received by individual wheat growers.

There is here indeed a certain contradiction between stabilization and elevation of prices. In the interests of raising prices to the grower, in particular years and over a period of years, it is desirable that the prices he receives should fairly reflect the value of his particular product. If he raises high-quality wheat, he should get a substantial premium over the average or contract price; if he raises a low-quality wheat he should be paid accordingly. Only by such differentiation can the desirability of raising high-quality wheat be brought home to the grower. Such differentiation, which has already developed much further than before the war, implies a continuous variation in prices with the grade and quality produced. To minimize these differences, if it were feasible, would entail stabilization at the expense of improvement of returns to the growers as a whole in the longer run.

Substantial stabilization of returns to the individual wheat grower, or substantial stabilization of his per bushel prices, therefore lie outside the scope of practicable policy, although certain measures designed to reduce the instability of his returns per bushel and per acre might appropriately be tried out as supplementary to a price stabilization policy. To say this does not imply that there is no field for price stabilization measures; it merely indicates that those measures, even if successful, cannot effect the degree of improvement that is earnestly desired.

The field of price stabilization measures is to be regarded, then, as the moderation of terminal market fluctuations within a season and from one crop year to another, in the level of wheat prices or in some important elements in that range. These fluctuations have been large. To a considerable extent, they have caused variations in wheat growers' returns. To moderate them would tend to reduce the fluctuations in farm prices per bushel and per acre, and the corresponding financial hazards of wheat growing. Conceivably it might also help to elevate the growers' farm returns somewhat, but it cannot be relied upon to do this

[1] See "Variations in Wheat Prices," WHEAT STUDIES, June 1929, V, 246–54.

in any large measure, unless accompanied by other measures.

Thus under a program of strict stablization, the wheat price level would be regarded as acceptable (except in extreme instances) because inevitable under the circumstances of partial dependence of domestic price on world price. What would be sought is conformation with the price level without untoward deviations and fluctuations, especially during the marketing season, making the best of the existing situation. Outside of mixing wheat, merchandising premium wheats, and working profits in handling diverse wheats, price elevation might still be sought, under appropriate circumstances, in opportunistic marketing, including the storing of wheat over the winter, the dumping of wheat abroad, and storing wheat from one crop year to another. What the Board would regard as appropriate circumstances would depend in part upon its view as to the predominating influence of the world wheat price level, in a particular year, upon the net returns secured by wheat growers.

It must also be kept in mind that stabilization of price, strictly construed, means restraint of rise as well as restraint of decline of price. Unless the policy of stabilization includes the policy of price elevation, a bilateral operation is implied in the term. But the physical possibilities are not identical in the two directions. In the event of large crop and declining price, wheat can be withdrawn from the market and added to the carryover, as conventionally defined, or indeed impounded. The amount of wheat withdrawn from the market and the length of time it might be carried in expectation of, or preparation for, a subsequent short crop would depend upon the amount of money the Board was prepared to invest in carrying wheat. Sooner or later, the short crop would arrive and the impounded wheat would then be marketed, primarily for the purpose of increasing the wheat price of the year in which it was harvested. Inevitably, however, the effect would also be to reduce the price of wheat in the crop year in which it was sold, and the net result might be a loss.[1]

But suppose a short crop of wheat arrives in a season with a normal incoming carryover. The price rises. Suppose only (or predominatingly) the domestic price, not the world price, rises. When the domestic price has risen to the level where it will pay millers to import duty-paid Canadian wheat, this will check further rise. In the interval, however, the Board could do little to prevent the rise in price, and it could not stabilize the price of wheat. The Board could not import duty-paid wheat and throw it on the market at less than cost in order to check the rise and stabilize the price; commercial imports alone would be relied upon to do this. This all is assuming that the Board desires to check the rise, before the intervention of duty-paid commercial imports.

In summary, the Agricultural Marketing Act provides for a comprehensive reorganization of co-operative marketing and rationalization of distribution of agricultural products. It does not contemplate a differential elevation of the domestic price level. Despite the conspicuous use of the word stabilization, in our view stabilization of the price level, strictly construed, is not mandatory under the Act. As will be later indicated, some stabilization of the price movement should attend the successful merchandising of wheat under the Farm Board; also the price of wheat may be improved and wheat returns enhanced. The Act, however, is so broad that the Farm Board could at its own election undertake a policy of positive stabilization of the wheat price or a policy of enhancement of the wheat price level. While not disposed to oppose the view that the Farm Board would take exceptional measures in the direction of stabilization and price enhancement under circumstances of unusual emergency, we cannot believe that such measures will be adopted as routine policy. Our views as to the adaptability of merchandising procedures, and the unadaptability of procedures of price stabilization and differential enhancement of the price level of wheat, will be developed in the succeeding sections.

[1] Cf. Mordecai Ezekiel, "A Statistical Examination of the Problem of Handling Annual Surpluses of Nonperishable Farm Products," *Journal of Farm Economics*, April 1929, XI, 211; John D. Black, *Agricultural Reform in the United States* (New York, McGraw-Hill, 1929), pp. 349–66; and House Committee on Agriculture, *Agricultural Relief Hearings*, March 27, 1929, Serial A—Part 1, pp. 30–31.

II. DEFINING THE SURPLUS OF WHEAT

The discussion of surpluses and surplus control have been much confused by vagueness of concepts and misleading use of terms. If the Farm Board is to succeed, it will need to get clearer concepts of significant kinds of surpluses than have been prevalent, and to be in a position to obtain quantitative estimates of the surpluses and their composition and location. It is therefore desirable to seek some clarification of the meaning of different kinds of surpluses, with special reference to wheat.[1]

Types of Surpluses

"Consumption surplus." There is never a surplus of wheat, or other relatively non-perishable commodities, in the sense that more is produced than could be consumed, or than is actually used. Even in the case of the most perishable commodities, there is rarely a surplus over what could be consumed in regions that could be reached before the products spoiled; but in such cases there is often a surplus of production over what is actually used, for part of the crop is not harvested at all because the price obtainable is insufficient to cover the bare costs of harvesting and marketing, and part of the marketed crop spoils because of delay in marketing. In the case of wheat, however, the largest part of the crop enters into the marketed supply; spoilage on the farm or attributable to delay in marketing is of little consequence; and what is raised is consumed by man, beast, or industry.

"Current surplus." For almost all commodities, on the other hand, there is regularly a surplus over immediate requirements. In the case of quickly perishable commodities such a surplus may last for only a brief period; for those like eggs and apples, that can be economically stored from periods of heavy production, the period of surplus is more or less prolonged; for relatively non-perishable crops like wheat and cotton there is rarely a time when there is not a surplus in this narrow sense of an excess over requirements for current utilization. This use of the term surplus brings out the need of considering prompt, effective, and economical marketing of perishables; of developing effective and economical means of preservation and storage; and of processing or otherwise disposing of part of the product in the flush season so as to check extreme declines of price at particular seasons. But for non-perishables such as wheat and cotton this meaning of the term surplus is not usually of comparable importance.[2]

"Carryover surplus." Of more importance is the surplus in the sense of carryover from one crop year into another. A certain amount of old-crop wheat is normally carried over into a new crop year, to facilitate merchandising and milling operations. The quantity that may be regarded as minimal varies somewhat with the prospects for the new crop, in quantity, quality, and period of harvest and marketing. Beyond the minimum desirable for what may be called administrative convenience, there is usually an addition of greater or less amount resulting either from misjudgments in the marketing of the old crop or prospects of realizing sufficiently better prices in the next crop year to offset the carrying charges. One of the outstanding features of the wheat crop year 1928–29 was the prospect in the markets of a "burdensome" carryover, i.e., one so greatly in excess of administrative requirements as to affect the wheat prices adversely. A surplus in this sense does not appear in the case of perishable products that cannot be stored over a season, except as it often appears for them in dried, canned, or otherwise processed forms. But it does appear in the cases of many relatively non-perishable farm products.

"Exportable surplus." Of a different character and much greater significance with

[1] Cf. B. H. Hibbard, "The Agricultural Surplus," *Journal of Farm Economics*, April 1926, VIII, 194–207, and a mimeographed report on "Agricultural Surpluses," made on March 15, 1926, by a sub-committee (Drs. W. E. Grimes, B. H. Hibbard, and G. F. Warren) to the Special Committee on Marketing, Distribution, and Surpluses, appointed by the Joint Committee on Projects and Correlation of Research of the Association of Land Grant Colleges and the U.S. Department of Agriculture.

[2] In May of this year several trunk line railroads lowered the export rates on grain, following the view that an "emergency of national proportions in agriculture exists, necessitating every possible aid to the immediate removal of a grain surplus out of the country."

reference to wheat and certain other products is the exportable surplus, which may be defined as the excess of crop plus inward carryover over domestic requirements for seed, food, and feed plus the amount of outward carryover necessary for merchandising convenience. Domestic requirements are relatively constant, though not absolutely so.[1] Seed requirements vary a little with acreage sown; food requirements vary a little with quality, price, business conditions, growth of population, and trends in per capita consumption. Feed requirements vary somewhat with the amount of low-grade wheat, count of poultry, etc., and prices of competing feedstuffs. The administratively desirable carryover varies somewhat with the qualitative proportions of the old crop, the period of harvesting and crop movement, the size and composition of the prospective harvest, and so on. The exportable surplus cannot be estimated with precision, not only because the foregoing elements are not invariable but because of errors in crop estimates. Even so, the exportable surplus can be approximated within limits that are not very wide. The volume of actual exports in any year, however, affords no close check upon estimates of the exportable surplus. This is chiefly because of the possibility of substantial variation in outward carryover. Exports in a particular year may exceed the exportable surplus from the preceding *crop,* but exports almost invariably fall short (by widely varying margins) of the exportable surplus calculated from the crop plus inward carryover. Similarly, forecasts of probable exports usually run below estimates of exportable surplus, because it can usually be forecast that the outward carryover will not be reduced to minimum proportions. In the case of countries like Canada, Argentina, and Australia, which produce wheat primarily and predominantly for export, the term surplus is commonly used in the sense of exportable surplus; and the sense is important in the case of wheat in the United States.

"Economic surplus." In the post-war usage in the United States, however, the term has frequently been employed in a quite different sense, less susceptible of expression in terms of quantity. Though we almost always produce more wheat than we use domestically, we no longer produce wheat on a large scale primarily for export. Moreover, wheat growing has been, during several of the last few years, unremunerative to a large proportion of the growers. Hence the term surplus has come to be commonly if somewhat vaguely applied to that fraction of wheat crop which prevents the marketing of the crop at prices remunerative to the growers as a whole. Thus for example, if a crop of 900 million bushels is produced when a crop of only 800 million could be marketed at remunerative prices, the surplus is 100 million bushels, because the existence of this excess depresses the price of the entire crop below remunerative levels. In this sense a wheat deficiency would exist if only 700 million bushels were produced, with the result that prices rose above levels generally regarded as remunerative. The surplus in this sense is not identical with the exportable surplus. In an occasional year of world shortage and large United States crop (as in 1924–25), we may have a large exportable surplus and export heavily, yet have no recognized price-depressing surplus. In a quite different year in the world market (as in 1928–29) we may have an economic surplus approximating the exportable surplus and substantially exceeding actual exports.

The size of this economic surplus would thus depend upon several factors. Chief among these is the level of prices considered remunerative. A farm price of $1.50 a bushel would almost certainly be regarded as remunerative, though a good many high-cost farmers would lose money at that price. A farm price of $1.25 a bushel would probably be remunerative under present conditions to the producers of the bulk of the crop, but many more than at $1.50 would find this price below their costs. Again, a price of $1.00 a bushel would be remunerative to some growers in certain areas in certain years, but would be regarded as unremunerative by the producers of the bulk of the wheat. The higher one fixes the price to be regarded as remunerative, the larger will be the surplus

[1] The domestic requirements may be taken as around 650 million bushels: 515 million bushels for food use, 85–90 million bushels for seed, and 50 million bushels, more or less, fed to animals, used in industries, and wasted.

whose existence prevents the attainment of the remunerative price.

Moreover, the volume of the surplus in this sense depends on world conditions of wheat supply and demand. If the world crop is short and the demand substantial, it may be possible to market remuneratively a United States crop of 900 million bushels, with little appearance of a "surplus." Under other conditions of the world wheat market, a crop of 800 million bushels would be a crop with a depressing surplus. In discussions on surplus, emphasis is commonly laid on the influence of the world price in depressing the domestic price. But under certain conditions of crop the world price improves the domestic price. For example, on account of a relative shortage in world crop with a corresponding world price, the domestic farm price for the larger crop of 1924 was considerably higher than for the smaller crop of 1923. Correspondingly, stress is laid on the necessity of export as explanation of low domestic price of wheat. But if the avenue for export were not open, in many years the domestic price of certain grades of certain wheats would fall still lower in consequence and their prices would tend more closely than is now the case to approximate those of the coarse grains. Since the war the influence of world price on domestic price has usually been downward; but in the period 1907–15, the influence seems unquestionably to have been in the upward direction.

Such considerations indicate the difficulty of expressing the economic surplus in terms of figures, and account for the vagueness of the term. The implication is, however, that wherever a crop is so large as to result in prices below levels generally accepted as remunerative, a surplus exists. Whether this surplus is large, as in some years, or small, as in others, it is viewed as a thing that farmers would be better off without. This view of the surplus has led to proposals for segregating the surplus fraction, disposing of it for what it will bring in such a way as to raise the price on the rest of the crop to a level not merely remunerative in itself but sufficient to cover also the loss on the surplus fraction.

The contrast between exportable surplus and economic surplus can be seen more clearly if one considers other crops. Take potatoes, for example. Because of their perishability and bulk, exports afford a comparatively negligible outlet for potatoes. Our export of potatoes has never reached 5 million bushels in any fiscal year. Economic surpluses of potatoes are of frequent occurrence, but for practicable purposes the export market affords negligible relief. The problem of dealing with an economic surplus of potatoes is almost wholly a domestic problem. Part of the crop will be left to rot in the ground. Part of it will be used more heavily than usual on the producing farms, or in the neighboring region, for food or feed. Part of it may be converted into processed foods or industrial products, though these outlets have not been highly developed in this country. Even with all these outlets utilized as fully as possible, the depressing effect of the surplus on prices may be such as to make a large crop yield less to the growers than even a crop of moderate size.

It is for such reasons that for the majority of crops produced in the United States the exportable surplus is a less significant concept than is the economic surplus. And even in the cases of wheat and cotton, the latter concept is of larger significance. It is a common misconception that attributes low prices of agricultural products to the fact that we produce certain commodities in part for a world market. The existence of an export outlet is frequently a source of advantage, not a regular source of loss. If we had no export outlet in the case of wheat, our economic surpluses of wheat would create reactions far more serious than those we have been facing. With all sorts of crops, production of a surplus over what can be sold at remunerative prices is of frequent occurrence. The problems presented are first to see what can be done to prevent the production of such surplus quantities, and second, when any have been produced, to find what steps can be taken to restrain the price-depressing influence of the surplus. The appropriate measures differ with different crops; but it is clear that the export outlet is only one channel of possible disposition of the surplus, and one which, even in the case of wheat, does not deserve sole consideration. In every case a serious difficulty is presented by the danger that restraints upon the price-depress-

ing influence of one surplus crop may lead to increased production and intensify the surplus problems of future years.

"Operative surplus." The wheat trade has its own idea of what constitutes a surplus, and whether it is advantageous or not. The trade uses what may be termed the operative definition of surplus. In the view of the trade, whenever the exportable supply encounters sales resistance in excess of the distributive and merchandising technique of the trade, irrespective of the relation of domestic wheat price to cost of production, an operative surplus is held to exist. This trade concept holds for all exporting countries. When the operative surpluses of several wheat-exporting countries meet on the world market, there results a "buyer's market," admitting of no hair-splitting definitions of what constitutes the complexion of a "buyer's market." On such a market, purchasers in importing countries pick and choose; despite the marked increase in consumption accompanying the decline in price, carryovers tend to accumulate. The contest on the side of the buyers is to secure the best wheat for the lowest price; the contest between the selling countries is to escape the burden of the carryover. Under such circumstances, the exporting country offering the poorest wheat and having the highest costs of production is most exposed. It requires no fine-spun analysis to indicate that whenever the world wheat trade has the complexion of a "buyer's market," wheat growers in the United States are apt to fare relatively worse than do growers in Canada, Argentina, and Australia, always assuming that none of these countries has a short crop.

When, on the contrary, the world wheat trade has the complexion of a "seller's market," the advantage tends to redound less to growers in the United States than to those in the competing export countries. Since the types of wheat available for export from the United States, and the quality within the type, stand relatively lower than those of Canada, Argentina, and Australia, other things being equal those countries stand to take fuller advantage of the rising wheat price level. In short, both for rising and declining wheat prices, the United States stands at a disadvantage. Thus, when an operative surplus exists in the world wheat market, American wheat growers stand to suffer a disproportionate share of the disadvantage; where an operative surplus does not exist, they stand to miss the proportionate share of the advantage. And whether the world's market be a "buyer's market" or a "seller's market," the wheat trade is not in doubt as to what the surplus consists of.

"Regional surplus." Somewhat analogous to the exportable surplus of the country as a whole is the surplus of a particular producing region over its requirements for seed, food, feed, and administrative stocks. In the case of wheat, there are surplus and deficiency regions; the surplus regions "export" to other domestic regions or to foreign countries. In the case of an economic surplus of wheat or of other commodities, the gravity of the situation appears primarily in the regions producing a surplus; but if there is no economic surplus of the commodity the existence of a regional surplus creates no problem. On the contrary, if there is no economic surplus, the larger the regional surplus the better, as a rule, for the region concerned.

"Type or quality surplus." Either exportable surpluses or economic surpluses would occur if commodities were homogeneous, as they do when in fact a given crop also contains products diverse in type, quality, and value. But it is usually important to take account of such differences in appraising the surplus, exportable or economic. Our exportable surplus of wheat, for example, commonly consists of several diverse elements: low-grade wheats of all types, which are but little in demand here but are suitable for food use under standards less exacting than those of our domestic milling and baking industries; low-grade flours which are in a sense by-products of the production of superior flours; representative durum wheats, which we routinely produce for export; representative Pacific wheats, which are usually produced in excess of quantities that can be marketed domestically to advantage, chiefly because of geographical factors; and less often representative hard winter, soft winter, and hard spring wheats, and high-grade or representative flours. Our economic surplus of wheat, when it exists, consists in large measure of substandard

wheats and flours which are not highly esteemed in domestic or foreign markets, but which stand relatively higher in certain foreign markets than in our own. The surplus is price-depressing in the sense that there is more or less competition of this wheat with wheats of higher types and qualities. Much of this wheat represents the culls of the crop; it is not what farmers set out to produce.

The Wheat Surplus Problem

In the light of these facts, the surplus problem is quite different from what it would be if the surplus consisted of standard high-grade wheat. The channels of disposition and the problem of carryover, among other things, are significantly different. Unfortunately in most of the discussion of surplus problems this phase of the matter is lost sight of; but a Farm Board dealing with actual commodities could not afford to lose sight of it, in connection with wheat, corn, cotton, potatoes, apples, or animal products. It would find a mere estimate of the amount of exportable surplus of little or no value. It would need to know not merely the amount of the crop and the amounts that domestic uses could absorb at various prices, but the extent of the economic surplus, if any, the character of that surplus, its appearance in time and region, and the probable outlets, export and otherwise, for surpluses of the character that were emerging.

The post-war surplus problem presents few phases for which precedents do not exist in our own history. Ever since colonial days there have been individual years and periods of years in which large crops depressed prices to the detriment of the growers, or years in which conditions abroad reacted adversely upon American farmers. Tobacco, cotton, wheat, corn, and lesser crops have all afforded numerous examples of economic surpluses in our agricultural history. Indeed it is to be questioned whether agricultural surpluses in general have been more "burdensome" since the war than they were in the eighteen-nineties and in some earlier periods of our history. We have had in the past repeated instances of injury to farmers in an older producing region as a result of opening up new producing regions in this country, or the improvement or cheapening of domestic transport facilities—as has occurred since the war with the expansion of wheat acreage in the Southwest and on the western edge of the Great Plains, and with the specialization in fruit and vegetable growing in Florida, Texas, Colorado, Utah, California, and other states.

Since the war, however, several conditions have combined to cause the persistence of a surplus problem: an expanded production of wheat and other products under stress of war demands; a slackening of the rate of population growth; a tendency to declining per capita consumption of farm products, particularly of several home-produced staples including wheat; a large-scale substitution of automotive equipment for horses and mules, and of gasoline for horse feed; and an increased farm productivity per man or animal unit. Furthermore there has been a marked expansion since the war in the wheat output of Canada, Argentina, and Australia, a striking recovery in the wheat crops of Europe, and similar expansion or recovery in the output of other farm products abroad, together with a slackening in the recovery of cotton consumption in this country and abroad. In consequence, apart from "climatic surpluses" of various crops, there has been a more or less persistent surplus of farm products as a whole.

So far as concerns wheat in particular, there have been additional new developments. Apparently the average quality of our crop has deteriorated, and the milling and baking industries have become more discriminating in their selection of wheat and flour. Our durum wheat acreage has expanded more than our hard spring wheat acreage. The tractor and combine harvester have proved applicable and have been increasingly employed on certain kinds of wheat farms, and have facilitated the extension of wheat growing in semi-arid areas heretofore beyond the extensive margin of cultivation. In some areas costs of raising wheat have probably been lowered, after allowance for changes in purchasing power of the dollar; but in other areas they have risen or at least not declined. These developments have increased the size and changed the character of our exportable

surplus. Another change, whose influence may easily be exaggerated, is the transition of the United States during the war from a debtor country, which paid out of export surpluses the interest and portions of the principal of our foreign indebtedness, to a creditor country whose export surpluses are not needed for debt purposes and seem in part to facilitate the increase of our creditor position.

The surplus problem is often viewed as in large part an export problem: how to sell abroad a surplus over domestic requirements and yet maintain domestic prices on a high level behind the tariff wall, or at least on a level clearly remunerative to growers. This is the formulation of the problem that fits closely with the notions behind price-elevating plans such as the equalization fee or the export debenture. It is clear, however, that such a formulation can apply only to a small number of crops, and there is grave question whether the plans based upon it would really yield a net advantage to growers over a period of years. This view emphasizes the "exportable surplus," regards its existence as an incident in our agriculture, blames it for depressing farm prices, and regards its segregation and separate disposition as a major task of the Farm Board.

A truer view, in our judgment, would emphasize the "economic surplus" rather than the exportable surplus, and would visualize the surplus problem as a dual one of seeking to lessen the frequency and degree to which economic surpluses occur, and to manage and dispose of economic surpluses when they occur through various channels, domestic and export, in such ways as to prevent them from depressing prices below levels remunerative to the growers. Surpluses call for different action according to the nature of the crop and the amount of the economic surplus. In some cases, such as wheat and cotton, the export fraction calls for special attention. But the problem is significantly different from what it would be if the exportable surplus were regarded as the heart of the problem.

The Agricultural Marketing Act contains the following definition of surplus:

> There shall be considered as a surplus for the purposes of this Act any seasonal or year's total surplus, produced in the United States and either local or national in extent, that is in excess of the requirements for the orderly distribution of the agricultural commodity or is in excess of the domestic requirements for such commodity.

We interpret this to cover both economic and exportable surpluses, but with the stress laid upon economic surplus. This view is reinforced by the declaration that it is the policy of Congress to promote the effective merchandising of agricultural commodities in interstate and foreign commerce; and that the Act is designed to function

> by aiding in preventing and controlling surpluses in any agricultural commodity, through orderly production and distribution, so as to maintain advantageous domestic markets and prevent such surpluses from causing undue and excessive fluctuations or depressions in prices for the commodity.

The two concepts employed in the Act are in part inconsistent. In the sense of exportable surplus, the size of the surplus varies directly with the crop. In the sense of economic surplus, however, the surplus of wheat might be smaller in a year of larger crop than in a year of smaller crop. For illustration, the surplus of the crop of 1924 (864 million bushel crop) was smaller than the surplus of the crop of 1926 (831 million bushel crop), because the crop of 1924 was the more easily merchandised and the farm price substantially higher. Conceivably a large crop might offer little corresponding to an economic surplus under the Act, while a relatively small crop might offer a heavy one. If we had a billion bushel wheat crop with a short wheat crop elsewhere in the world, with high world price there would be no economic surplus, according to the Act; whereas with a wheat crop of 800 million bushels along with a bumper world wheat crop, with low world wheat price there would be a large economic surplus, according to the Act.

Acreage Surplus and Yield Surplus

Whether one concentrates attention upon exportable surplus or economic surplus, a primary question concerns the factors proximately responsible for the existence of the surplus. The term "acreage surplus" may be applied to the surplus that results because of a large planted acreage with no more than average yields per planted acre,

and the term "climatic surplus," accorded to a surplus resulting from yields per acre above average because of weather and other conditions favoring light abandonment or good yields. The terms suggest a different type of responsibility for the surplus, exportable or economic: the acreage planted is to a large extent determined by the farmer's intentions; the yield per acre is largely independent of his control. In fact the division of responsibility can seldom be allocated as precisely as the terms seem to imply. But it can readily be shown that in the case of wheat, for example, we have regularly planted acreages which with average yields would yield an exportable surplus, if not an economic surplus; that variations in yield have merely altered the size of the exportable surplus; and that our economic surpluses of wheat have been the joint result of acreage and yield per acre in the face of certain conditions in the world wheat market. The inference is drawn that the nation has a larger responsibility for the disposition of climatic surpluses than for the disposition of acreage surpluses. Whether the Farm Board would take this view cannot be asserted; but it may wisely seek to find out how far each of the two factors is responsible for surpluses that exist. In particular it could ill afford to take care of a climatic surplus in such a way as to increase an acreage surplus. This danger is basic, to an extent not fully appreciated by most of the advocates of surplus control measures.

It is worth while to analyze the statistical data of wheat acreage and yields in the past twenty years, with special reference to the exportable surplus.

In the appraisal of the relative importance of acreage and yield in the determination of exportable surplus, the Farm Board would probably confine its attention to the wheat crops of the past twenty years; certainly it would not prove advantageous to go back of 1900. On account of regional changes in wheat growing, trend in acreage and trend in yield, comparisons between the wheat crops in the period 1889–1909 and in the period 1909–29 would be likely to prove hazardous. Also, the statistical data covering the past twenty years are more complete, and in every way better, than in the decades prior to that date.[1]

Table 1 contains the data on the wheat crops harvested since 1909 in the order respectively of acreage, production, and yield per acre. The acreage figure in each year is the sum of the planted winter-wheat acreage of the previous autumn plus the harvested acreage of spring wheat, in conformity with the view that agricultural effort and outturn are judged better on the basis of planted than of harvested acreage. Obviously it is assumed that harvested

TABLE 1.—ORDER OF WHEAT CROPS, 1909–28*

Year	Acreage planted[a] (*thousand acres*)	Year	Production (*thousand bushels*)	Year	Yield per acre planted[b] (*bushels*)
1909..	46,199	1911..	621,338	1925..	11.1
1910..	50,011	1910..	635,121	1916..	11.2
1913..	51,759	1916..	636,318	1917..	11.3
1912..	52,472	1917..	636,655	1911..	11.7
1911..	53,029	1925..	676,429	1923..	12.0
1914..	54,691	1909..	700,434	1921..	12.4
1924..	55,795	1912..	730,267	1919..	12.6
1917..	56,191	1913..	763,380	1920..	12.6
1916..	56,852	1923..	797,394	1910..	12.7
1926..	59,237	1921..	814,905	1922..	12.8
1925..	60,869	1926..	831,040	1928..	13.1
1915..	61,592	1920..	833,027	1927..	13.6
1927..	64,434	1924..	864,428	1912..	13.9
1918..	65,177	1922..	867,598	1926..	14.0
1921..	65,907	1927..	878,374	1918..	14.1
1920..	65,988	1914..	891,017	1913..	14.7
1923..	66,242	1928..	902,749	1909..	15.2
1922..	67,889	1918..	921,438	1924..	15.5
1928..	68,825	1919..	967,979	1914..	16.3
1919..	76,683	1915..	1,025,801	1915..	16.7
Mean	59,992	.....	799,785	.....	13.4
Median	60,053	.....	822,972	.....	12.9

* Data on acreage and production from *Agriculture Yearbook, 1928*, pp. 670 and 676 (except for year 1909, which were obtained from the Department of Agriculture).

[a] The figure for each year is the sum of the spring-wheat acreage harvested in that year and the winter-wheat acreage sown in the preceding fall.

[b] The weighted average yield per acre planted for the period was 13.3 bushels.

[1] According to the amendment offered by Senator Norris, when the optional export debenture proviso of the McNary farm relief bill was pending in the Senate, the average wheat production of the last five crop years would be utilized as the base line, and the forthcoming wheat crop would not be regarded as excessive in surplus unless it were over 120 per cent of the base line. The average of the five crop years 1924–28 was 830 million bushels, 120 per cent of which would correspond to 996 million bushels. A wheat crop of this size has been secured only once in our history, in 1915; the 900-million-bushel mark has been passed only four times—in 1915, 1918, 1919, and 1928.

spring-wheat acreage is identical with planted spring-wheat acreage; this of course is untrue, but a significant error can hardly have been introduced thereby. Table 2 illustrates the crops that would have been produced with the stated acreage over the period at the yield per planted acre of the mean for the period, together with the amounts by which such an average yield would have exceeded or fallen short of the reported crop. It also shows the yields per planted acre over the period with the deviation in units of the bushel and in terms of percentage of the mean yield of the period.

There has been, of course, an upward trend in the wheat acreage, which is confused by regional developments over the past thirty years; probably there has been also an upward trend in yield per acre, since improvement in strains and selection of seed have tended with each decade to make for enlargement of yield. Trends in acreage and in yield, however, hold only secondary significance for the practical definition of surplus in the immediate future. Regarding the acreage planted for the crop of 1919 as abnormal, within a decade the acreage planted to wheat expanded progressively from 50 to 65 million, with variations up and down since 1920. This expansion has included the new acreage, shifts from other grains to wheat and from grass land to wheat, in different proportions in different years.

Over the two decades the variations in yield per acre have been relatively wide, but differences in yield per acre by regions have been much wider. It has been the balancing effect of varying yields per acre in the four large wheat regions that has contributed a significant, if relative, stability to the average yield per acre. During the period under review in four years the yield (per planted acre) was below 12 bushels per acre; in six years it ranged from 12 to 13; in three years from 13 to 14; in three years from 14 to 15; and in two

TABLE 2.—ACTUAL AND HYPOTHETICAL PRODUCTION OF WHEAT IN THE UNITED STATES, AND YIELD PER PLANTED ACRE, WITH DEVIATIONS OF YIELD FROM AVERAGE YIELD OF PERIOD, 1909–28*

Year	Acreage planted[a] (*million acres*)	Hypothetical production at yield of 13.4[b] bushels per planted acre (*million bushels*)	Actual production (*million bushels*)	Deviation of actual production from hypothetical production (*million bushels*)	Yield per acre planted (*bushels*)	Deviation from average yield of period (13.4) (*bushels*)	Deviation from average yield of period (13.4) (*per cent*)
1909	46.2	619	700	+ 81	15.2	+1.8	13
1910	50.0	670	635	— 35	12.7	—0.7	5
1911	53.0	710	621	— 89	11.7	—1.7	13
1912	52.5	703	730	+ 27	13.9	+0.5	4
1913	51.8	694	763	+ 69	14.7	+1.3	10
1914	54.7	733	891	+158	16.3	+2.9	22
1915	61.6	825	1,026	+201	16.7	+3.3	25
1916	56.9	762	636	—126	11.2	—2.2	16
1917	56.2	753	637	—116	11.3	—2.1	16
1918	65.2	874	921	+ 47	14.1	+0.7	5
1919	76.7	1,028	968	— 60	12.6	—0.8	6
1920	66.0	884	833	— 51	12.6	—0.8	6
1921	65.9	883	815	— 68	12.4	—1.0	7
1922	67.9	910	868	— 42	12.8	—0.6	4
1923	66.2	887	797	— 90	12.0	—1.4	10
1924	55.8	748	864	+116	15.5	+2.1	16
1925	60.9	816	676	—140	11.1	—2.3	17
1926	59.2	793	831	+ 38	14.0	+0.6	4
1927	64.4	863	878	+ 15	13.6	+0.2	1
1928	68.8	922	903	— 19	13.1	—0.3	2

* Data on acreage and production from *Agriculture Yearbook, 1928*, pp. 670 and 676, except for year 1909, which were obtained from Department of Agriculture.

[a] The figure for each year is the sum of the spring-wheat acreage harvested in that year and the winter-wheat acreage sown in the preceding fall.

[b] Average of yields per acre for years 1909–28.

years each between 15 and 16, and above 16 bushels per acre.

From the data several obvious inferences may be drawn. In every year there was more or less of an exportable surplus. There were three years in which climatic surplus clearly predominated.

Year	Acreage (*million acres*)	Crop (*million bushels*)	Yield per acre planted (*bushels*)
1909	46.2	700.4	15.2
1914	54.7	891.0	16.3
1924	55.8	864.4	15.5

There were seven years in which acreage surplus obviously predominated.

Year	Acreage (*million acres*)	Crop (*million bushels*)	Yield per acre planted (*bushels*)
1919	76.7	968.0	12.6
1920	66.0	833.0	12.6
1921	65.9	814.9	12.4
1922	67.9	867.6	12.8
1923	66.2	797.4	12.0
1927	64.4	878.4	13.6
1928	68.8	902.7	13.1

Finally, there were two years in which both acreage and yield per acre were effective in the crop.

Year	Acreage (*million acres*)	Crop (*million bushels*)	Yield per acre planted (*bushels*)
1915	61.6	1,025.8	16.7
1918	65.2	921.4	14.1

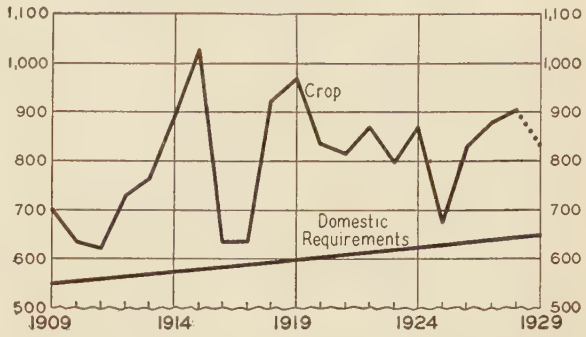
With the curve of wheat crop one must compare the curve of domestic wheat requirements, determined largely by growth of population but also by changes in disposition. At the beginning of the period under review, the flour consumption was about 1.08 barrels per capita per annum. The use of wheat for seed varies directly with acreage, with slight changes from region to region. Wheat lost by waste and fed to animals varies from crop to crop, but no serious mistake will be made if this is taken as a constant. Thus approximately determined, the curve of domestic wheat requirements over the period (not including war years) may be taken *schematically* as a straight line, beginning at 550 million bushels in 1909, and ending at 650 million bushels in 1929. Chart 1 presents the curve of domestic wheat requirements and the curve of wheat crop, to serve as an approximate illustration of the surplus over domestic needs.

What amount of wheat in excess of annual domestic requirements should be produced annually as insurance of the food supply? To this estimate, extravagant expressions are commonly devoted; indeed, one might imagine from numerous expressions to be found in Congressional hearings that the wheat supply of the United States is in constant jeopardy. Such apprehensions are devoid of foundation in the history of our crop reports. Never in our history has the yield of wheat fallen so low as to approximate the requirement; only three times has it approached within 50 million bushels of it. We have four wheat regions, we have both fall-sown and spring-sown wheat. It is possible to imagine a series of climatic calamities which would so affect all regions and all types of wheat as to reduce the crop below 600 million bushels; but such a combination of disastrous circumstances has never occurred and the prospect is extremely remote. If such a thing should occur, we would have rye and coarse grains to fall back upon, also a surplus of wheat in Canada, where a crop failure to the level of domestic need is unthinkable. The historical wheat acreage of the United States cannot be justified on the basis of insurance of the food supply.[1]

In fact, there has always been an acreage surplus, the effect of which in some

CHART 1.—UNITED STATES WHEAT CROP AND DOMESTIC REQUIREMENTS, 1909–29*

(*Million bushels*)



* Data for crops from *Agriculture Yearbook, 1928*, p. 670. See note, p. 356, for comment on domestic requirements. The dotted line for the 1929 crop stands much above the most recent estimate.

[1] Cf. "The Dispensability of a Wheat Surplus in the United States," WHEAT STUDIES, March 1925, I, 121–42.

years has been exaggerated by a surplus of yield. Leaving individual years and taking groups, the possible occurrences may be illustrated by the averages of the four lowest, the four median, and the four highest acreages, with yields representing the average of the four lowest, the four median, and the four highest yields per acre. These are given in Table 3.

TABLE 3.—POSSIBLE WHEAT CROPS, BASED ON RANGE OF PLANTED ACREAGE AND YIELDS PER PLANTED ACRE FROM 1909 TO 1928*

Planted acreage (*million acres*)	Crop resulting at an average yield per acre		
	Four lowest yields (11.3) (*million bushels*)	Four median yields (13.0) (*million bushels*)	Four highest yields (15.9) (*million bushels*)
At average of four lowest planted acreages (50.1)	566	651	797
At average of four median planted acreages (59.6)	674	775	948
At average of four highest planted acreages (69.9)	790	909	1,112

* Based on data in Table 1.

Obviously 50 million planted acres would leave us with a deficit only if the yield represented the average of the four lowest yields; it would furnish enough if the yield represented the average of the four median yields. Fifty-nine million planted acres would furnish enough wheat if the yield represented the average of the four lowest yields. Of this we have a good illustration in the crop of 1925, when the planted acreage was 60.9 million, the yield 11.1 bushels per acre, and the crop 676 million bushels.

It seems to us that the common-sense inference to be drawn is that 60 million acres planted to wheat represents an outside conservative estimate of the acreage required to cover domestic needs, insure the food supply, facilitate milling operations, and provide a moderate export. Sixty million planted acres yielding only 11.1 bushels per acre would furnish 666 million bushels; at the average of the four lowest yields, it would furnish 678 million bushels; at the average yield of the period it would furnish 804 million bushels. Three times since 1917 —in 1924, 1925, and 1926—the planted wheat acreage has fallen below, or approximated, 60 million acres, furnishing crops of 864, 676, and 831 million bushels. With these are to be contrasted the years 1920, 1921, 1922, 1923, 1927, and 1928. With full recognition of the influence of world price on domestic price, it is clear that the years with large domestic acreage have been years of relatively low wheat price and the years with low domestic acreage have been years of relatively high wheat price. If one will take the yields per acre during the six crop years 1920–24, and 1927–29, and multiply them by 60 million and subtract the figures thus obtained from the reported wheat crops of those years, one will obtain figures for amounts of wheat without which prices would have tended substantially higher. There is no question that, other things equal in world price, domestic wheat acreage is inversely reflected in wheat price. Also, it is equally certain that the predominating cause of wheat surplus in the United States is not high yield due to climate, but overplanting.

It is commonly stated that large crops sometimes, or often, or usually, bring in a smaller gross return than do small crops. Obviously, the relation between size of domestic crop and domestic price would be different with a crop on the domestic basis than with a crop on the export basis. While the world price tends to influence the domestic price of wheat, at the same time an export outlet tends to prevent the domestic price of a crop from falling to where it would fall in the event of a bumper crop of a product not exportable. Thus, with a crop on the export basis both extremely high and extremely low prices are avoided, through the stabilizing influence of the broad international market. Peterson[1] has recently charted the relations of production to total farm value and costs of a series of staple agricultural products. Pointing out that during the past 42 years yields of wheat were within 10 per cent of normal in 31 years (for acreage harvested), and making certain assumptions as to costs, Peterson plotted his findings on charts to

[1] G. M. Peterson, "The Relation of Annual Weather Surpluses to Net Farm Incomes," *The Annals of the American Academy of Political and Social Science*, March 1929, CXLII, 391–401.

indicate that wheat (in contradistinction to oats, corn, cotton, and potatoes) gives increasing returns with increasing production.

The Question of World Surplus

The wheat situation in the United States cannot be intelligently appraised without reference to the world wheat situation. This would be true even if we produced no exportable surplus, but it is much more important so long as we do produce a surplus for export. In considering the problems created by our own surplus, the Farm Board would necessarily have to appraise, through appropriate agencies, the surplus or deficiency situation in the world wheat market, and in particular the position in exporting and importing countries. Here the question would be not so much how large the combined exportable surpluses or the volume of international trade promise to be, as the extent to which, if at all, an economic surplus exists as a result of new crops plus inward carryovers.

The Farm Board will need to formulate appropriate concepts and make approximate estimates, with data more or less imperfect or deficient, of carryovers and crops, exportable surpluses and import requirements, at various levels of wheat prices, for countries active in international trade. To say that there can be no world wheat surplus because all wheat that is raised will be consumed or that there are hundreds of millions of people on the globe who could consume many times any probable increase in wheat supplies without completely satisfying their nutritional need for cereals, is to ignore the outstanding fact that economic surpluses, depressing prices to low levels unremunerative to growers, frequently occur in spite of these facts. In most years an addition of 200 or 300 million bushels to the world crop may make a notable difference to the remunerativeness of the crop of wheat.

In any year the problem of dealing with the American wheat surplus will vary with the surplus or shortage characteristic of the world wheat market. A large domestic surplus co-existent with a relative shortage in the world at large will present the easiest situation; a large domestic surplus with a large world surplus the most difficult one; but all variations are possible. Whether the domestic surplus or the world surplus will determine predominatingly the rule of action, would vary from crop year to crop year. To insure the possession of timely and dependable information, the Board might find it necessary to station competent and experienced observers in Argentina, Australia, Russia, and in western Europe. This would be necessary if the Farm Board were under compulsion to match its wits with those of the international grain traders, whose contacts have been long established and whose information (confidential in part) for the most part is demonstrably timely and usually accurate.

Surplus Control Operations

In the light of the foregoing discussion of surplus it appears that the Farm Board would need to combine the objectives of reducing or at least preventing the expansion of our domestic economic surpluses, with the objectives of increasing the returns to wheat growers from particular crops. Suppose it accepts as desirable four interrelated objectives:

1. Reduction of marginal wheat acreage.
2. Reduction of outturn of inferior wheats.
3. Moderation of influence of foreign wheat price on domestic wheat price.
4. Increase in average gross income per acre planted to wheat.

Let it be further assumed that in the interest of a provisional recommendation to wheat growers for adjustment of acreage, the wheat acreage be surveyed state by state with the view of contraction, just as it was surveyed during the war with the view of expansion. Finally, appraising the table since 1909 of acreage planted, crop harvested, yield per acre, domestic requirements, exportable surplus from the United States, and exporters' surpluses and importers' requirements in the world —where would the Farm Board suggest delimitation of acreage? At what limit of acreage would the Farm Board suggest that irrespective of bumper yields per acre loans could not be extended to carry over a surplus from one crop year into the next? At what limit of acreage would the Farm Board suggest that loans could be extended to carry a surplus from one crop year into

the next only in the event of yield per acre above a certain figure? In short, what acreage of wheat would be denominated as supportable from the standpoint of national policy and made the announced basis of the policy of the Farm Board? It is not easy to show that planted wheat acreage in excess of 60 million could justify itself as entitled to national financial support as an act of policy.

Suppose, however, the Farm Board should reject the objectives for wheat stated above, and act on the view of Peterson[1] that the returns on the wheat crop do not vary inversely with the exportable surplus. In this view they could fall back on the testimony of Professor J. D. Black of Harvard University, who expressed the following opinion at a recent Congressional hearing on farm relief legislation:

> The larger the crop of wheat, the more money in the aggregate the farmers receive for it. The wheat farmers are prosperous when there is a large crop of wheat. On the average, the farmers are better off when they have a large crop of wheat in the United States..... Large crops of wheat in the United States sell for more money than small crops of wheat.[2]

Taken at their face value, such statements might readily be interpreted to mean that for the wheat crop there is essentially no problem of surplus control, but only a problem of merchandising. The proponents of the equalization fee, of the export debenture, or of the farm allotment plan would urge that the domestic fraction and the export fraction of the wheat crop could be sold at two different price levels, higher for the domestic fraction and lower for the export fraction. But in the sense of finding the surplus to be the effect of high yield rather than large acreage, if wheat growers in the aggregate are better off the larger the crop, then the Farm Board would face a problem of merchandising rather than a peculiar problem of surplus control, of adjustment of production to demand.

These contrasting views make it clear that among the first duties of the Farm Board would be the definition of surplus of wheat and the determination of policy based thereon.

III. GENERAL CONSIDERATIONS ON ORGANIZATION AND POLICY

It is a fair assumption that if the Agricultural Marketing Act had been passed in 1914 with the same objective of reorganization and rationalization of distribution, the wording used would have been significantly different from that in the Act of 1929. This difference arises in part out of the prolonged legislative struggle; but in part it proceeds from the happenings of the past fifteen years. Under these circumstances have arisen connotations and implications, the elucidation of which is vital to any undertaking to appraise the inherent purpose of the Act and to prejudge the policy of the Farm Board in its execution. In an earlier section we considered the concept of "stabilization," upon which the events since the war have conferred a special significance. Indeed, what is involved in stabilization of the price movement or enhancement of the price level, as distinguished from rationalization of distribution, must become clear to anyone desirous of reaching a tentative opinion of the probable outcome of the new legislation. To this end, attention should first be given to certain considerations involving organization and policy.

Relation of Farm Board to the Grain Trade

It is the natural right of the producer to market his commodity as he may elect to do. The wheat grower may sell his crop to the nearest middleman, or he may seek out the consumer of wheat. The Capper-Volstead act legalizes the association of wheat growers for the purpose of extending their marketing operations to take over the functions of middlemen. The established grain trade holds no vested interest; although terminal warehouses have been judicially declared to be "affected with public interest," this does not endow grain merchants with a vested interest in the distribution of wheat. The present generation of wheat growers is not bound to employ commission merchants or to use commercial elevators

[1] *Op. cit.*

[2] Senate Committee on Agriculture, *Farm Relief Legislation Hearings,* March 26, 1929, p. 61.

merely because the last generation of wheat growers did so. Wheat growers have the natural right to change their marketing operations at their own volition; they need not prove their case for so doing to anyone except themselves. It is a distinctly different matter, however, for the government to promote, with support and resources, the substitution of co-operation for competitive marketing. Yet this is to be done.

Let us state briefly the views of wheat growers—not universally concurred in, of course—without appraisal of the evidence upon which these views are based. The spokesmen of wheat growers believe that under proper organization growers could render to themselves at lower cost the same distributive services now rendered by middlemen, or could give better service at the same cost. They are confident that a higher average grading of wheat on the farm would be secured. They believe the profits of mixing could be added to the farm price of wheat. They feel certain that the premiums for milling qualities would be more fully reflected to farm prices. Thus, they believe that wheat growers could add to their gross income the sum now accruing to middlemen as profits, with additional returns resulting from reorganization and centralization of the handling of wheat.

The implications, for the established grain trade, of the reorganization of marketing of wheat by wheat growers' co-operative associations, operating under a Farm Board and with loans from the public treasury, ought to be frankly faced and not treated with evasion. The wheat growers' co-operative associations are mergers of producers for the purpose, among others, of merchandising their wheat. As in the case of the Canadian pools, the producers, through instruments created for that purpose, will take over the handling, mixing, carrying, wholesaling, and exporting of wheats now carried on by middlemen, in order that the profits of these transactions now acruing to middlemen shall accrue to producers, along with such additional profits as may be otherwise achieved. In Canada, the wheat pools have to a large extent supplanted private elevator companies. The expansion of wheat growing in Canada has made the loss of volume suffered by private elevator companies more striking relatively than absolutely. In proportion as the wheat growers' co-operative associations succeed, independent elevators and merchants will retire from the field. This contingency, which is inherent in the movement, was clearly placed on record on behalf of the established grain trade in the testimony of F. B. Wells before the House Committee on Agriculture: "I believe in evolution, and if it is a better form of marketing, and is in the interest of the producers, I think eventually it will supplant the present system of marketing."[1] It may not be amiss to remark that the effort to have wheat growers' co-operative associations sell their grain direct to millers, feed manufacturers, and exporters is comparable with the efforts of manufacturers to sell their products direct to retailers instead of through wholesalers or other intermediary agencies. Direct selling of raw materials to proximate consumers and direct selling of finished goods to retailers or ultimate consumers are alike under way and on trial in the United States.

It is not in the public interest, however, to duplicate physical plants, with the result of overextension. The question of duplication of plants faces every co-operative movement. In Canada the expediency of duplication of grain elevators is of secondary importance, because grain acreage is in the course of undergoing long-term expansion. But in the United States, where grain acreage as a whole faces no such long-term expansion and is already well supplied with elevator facilities, the question of duplication of plants is important and pressing. In some of the newer wheat regions, sufficient elevator space is not now available, and in some areas elevators are not located to the best advantage. Apart from this, the system of grain elevators in the country is overextended, both in physical plant and in personnel, with consequent low volume of operations in relation to capacity. Savings could be made if the elevator plants of the country could be reorganized, with expansions in some places and contractions in other places, under centralized management and with appropriate reduction of their staffs. To date

[1] House Committee on Agriculture, *Agricultural Relief Hearings*, April 4, 1929, Serial A—Part 8, p. 727.

these desiderata have not been approached through the operations of farmers' elevators or co-operative associations. With organization of regional wheat growers' co-operative associations under the Farm Board, the utilization of existing elevator facilities (through purchase or contract with present owners), and the co-ordination and centralization of wheat handling, will represent outstanding administrative problems. Experience suggests that private elevators should be taken over at fair valuation and paid for out of loans or the owners allowed to operate them in such a way as to work out the purchase contract by amortization on agreed charges for services over a term of years.[1]

If the experiences of the past five years in Canada can be accepted as definitive in themselves and as applicable to the United States under the Agricultural Marketing Act, we may expect relations between the wheat growing co-operative associations and independent grain merchants to work out somewhat as follows. It is doubtful if the co-operative associations will secure membership equivalent to more than half the crop. A considerable proportion of wheat growers would be a liability rather than an asset to the co-operative association, on account of their credit requirements, their marginal characteristics, or for other reasons. There are types of wheat growing, and of wheat growers, that lend themselves better to independent than to co-operative management. It does not now seem likely that under the new sign-up the Canadian pools will control over half the crop of wheat in the Prairie Provinces; to this outcome the pool promoters are becoming reconciled and many of the wiser leaders are coming to regard it as a situation of relative advantage. In our judgment, the Farm Board will be wise not to capitalize the momentary enthusiasm into a sign-up larger than is justified by the characteristics of wheat farming, of wheat growers, and of wheat itself in the several regions. In particular, the projected wheat growers' associations ought not to become too pronouncedly the mergers of sub-marginal lands, methods, growers, and products.

[1] Cf. Agricultural Marketing Act, Sec. 7, (*c*) 3 and (*d*). Railway terminal elevators are a problem apart.

[2] See below, pp. 373–75 and 393–95.

The adaptations and adjustments on the part of the private grain trade, voluntary and involuntary, seem susceptible to forecast. Weak units will retire, either by sale to the co-operatives or to stronger independent units. Some redundant plant equipment, elevators that are obsolete in time or in space, will be closed down. The strong independent elevator companies will tend to merge into larger organizations. This process of merger is now actively under way in Canada. It is reasonably to be anticipated that corresponding developments in the United States will follow the organization of wheat growers' co-operative associations. The problem of adjustment between the co-operative associations and private elevator companies may prove more difficult here than in Canada, because with continuously expanding grain production in the Prairie Provinces the problem of over-capacity of elevators gradually solves itself, whereas in this country liquidation of plants will be entailed (except in a few regions) upon both co-operative associations and private elevator companies. An additional difficulty will lie in the new problems created by the harvester-thresher combine, which will need to be met by changes in country storage, both on the farm and in the town, and probably also in terminal storage in some areas.

It will also be necessary for the Farm Board most carefully to consider the commercial elevator system in its existing relations with futures trading on the grain exchanges. At present, the risk of trading in cash wheat is largely obviated through insurance afforded by hedging. The wheat growers might be prepared to take these risks by not hedging receipts in functioning for themselves as distributors, of which more will be said in another place.[2] But the milling industry, also, has for the most part based its operations on hedging. Any alteration in the distribution of wheat enforcing widespread changes in the current practices whereby mills secure their supplies, and hedge their purchases of cash wheat and their advance sales of flour, would introduce far-reaching complications. These complications would lie essentially outside of the domain of co-operative organization of wheat marketing. If the Farm Board, with the taking over of the

merchandising of wheat by co-operative associations and a merchandising corporation, were to deprive the milling industry of processes wherewith they now secure their raw material and safeguard their subsequent operations, it would need to face the problem of replacing established practices of the industry with other processes.

Relation of Farm Board to Wheat Growers' Co-operative Associations

We take it that the functions of the Federal Farm Board will be especially related to policy, authorization of loans, and such regulation of the practical procedures as would be necessary to safeguard the loans and to secure continuity of operations. The Farm Board will not itself enter into the wheat trade. We take it that the actual operations in trade would be conducted by wheat growers' co-operative associations, or/and a wheat growers' stabilization corporation, both of which have the right to borrow money from the government fund under regulations based on the Act.

As we interpret the application of the legislation to wheat, the organizational relationship would be as follows. We take it that four wheat growers' co-operative associations will be organized, sooner or later, because that would best fit in with the regional distribution of wheat growing and the characteristics of the types of wheat. These regional associations would be built up around the existing detached co-operatives and the farmer-controlled elevators, some five thousand in number. The Act evidently contemplates the appointment of a single wheat advisory committee, though there may prove to be need of four rather than one, because of the specialized knowledge involved. But we regard only one wheat stabilization corporation as advisable, in the interest of centralized management.

The legislation provides that where a co-operative association, qualifying under the Capper-Volstead act, does not exist and cannot be organized, other agencies may, in the judgment of the Board, take the place of the co-operative association. But the Act is designed to facilitate the organization of co-operative associations, and in view of the nature of wheat growing, we are unable to picture any other agency that could effectively supplant the co-operatives.

It is reasonable to infer that efforts will immediately be made to organize representative wheat growers' co-operative associations, and a stabilization corporation to work over them.[1] The co-operative associations would be incorporated, owned, and controlled by growers, under the Capper-Volstead act. The practical operations would not, however, be managed by growers. The merchandising of wheat is a technical specialty; management would need to be placed in expert hands, as has been done in the case of the selling agency of the Canadian wheat pools. The type of organization, and the details of contract of membership, need not be discussed here, but we infer that the business transactions of the co-operative association would be subject to audit by accountants reporting to the Farm Board. To what extent members who put in capital (that is, subscribe for shares) assume legal responsibility for debts and losses is an important question which need not detain us here, but to which the Farm Board will need to give grave attention.

For reasons to be stated below, the co-operative organizations to be created under the Farm Board would not need to control so large a proportion of acreage as would be advisable if they were to be isolated and self-sufficient organizations. The membership of the soft red winter-wheat association would hardly need to be extended outside the states of Missouri, Illinois, Indiana, and Ohio, in which is planted over one-half of the acreage annually seeded to soft

[1] Throughout this article we shall use the term "agricultural co-operative association" in the sense in which it is used in the Capper-Volstead act; the terms "advisory commodity committee" and "stabilization corporation" in the sense in which these terms are used in the Agricultural Marketing Act. But we employ the term "stabilization corporation" without connotations or implications; specifically, it is not to be understood to imply stabilization of price movement as the main objective. If one interprets "stabilization" to indicate and imply stabilization of marketing practices, rather than of terminal prices, the term is good. "Sales corporation" is too narrow a term and calls up analogues from industrial life that are not helpfully applicable to agriculture; in the same sense we regard "central selling agency" as too narrow a title to include the functions of the centralized merchandising agency of the Canadian wheat pools. Co-operative marketing of wheat includes much more than the selling of the wheat of members. In this broad sense we use the term set up in the new law, "stabilization corporation." A better term is "merchandising corporation."

winter wheat. The membership of the hard winter-wheat association would not need to extend outside the states of Nebraska, Kansas, Oklahoma, and Texas, in which is planted around 90 per cent of the acreage annually seeded to hard winter wheat. The membership of the hard spring-wheat association would not need to extend outside the states of Minnesota, the Dakotas, and Montana, in which is planted about 80 per cent of the acreage annually seeded to hard spring wheat. If a Pacific Coast wheat growers' association were to be organized, this would need to include only the states of Idaho, Washington, and Oregon, with over 4 million acres. Naturally, adjacent acreage would not be excluded. After this fashion, the associations would be compact and manageable in a sense not possible with more far-flung organizations. Such a scheme would make no specific provision for durum wheat—which might be included with hard spring, although its marketing problems would be quite distinct—or for detached and outlying areas.

The states named produce around 80 per cent of the crop. Many growers would not join; but organized under the auspices proposed, some growers would feel inclined to join who would not join independent co-operative associations. Nevertheless, it is doubtful if the associations could be counted upon to control over 50 per cent of the crop, at least at first.

Many believe, however, that such co-operative associations as would be organized with the support of and under the guidance of the Farm Board would be able to have practical control of the crop, even if the acreage under contract were relatively low, for two reasons. First, with a stabilization corporation and under the Farm Board, the associations would be adequately financed, and thus placed in position not merely to handle receipts of members, but also to deal in non-member wheat whenever desirable. Second, in the states named are located the strategic markets, and the wheat of the outlying districts, even if non-member wheat, would not tend to operate as a notably disturbing factor in the terminals.

Under these circumstances, properly managed co-operative associations ought to feel equipped to undertake control of the marketing of the crop without controlling the crop by contract with growers. This could be done, however, only in the event of the establishment of a proper system of accounting. Inadequate accounting (not dishonest accounting, but unclear and misleading accounting) has been the bane of co-operative associations. In far-sighted associations, it would seem necessary to safeguard loans from the government and to build reserves for contingencies. We assume that operative losses would not be repeatedly paid out of the revolving fund: they would need, we infer, to be assessed back on members, paid out of a reserve fund built up out of profits, or paid by special appropriation of Congress. In order not to jeopardize reserves, over-organization of growers and over-payment to growers would need to be avoided and selling costs restrained. Too often in the conduct of agricultural co-operative associations, the benevolent relation of the organization to its component members has led to a benevolent grading of the products and a benevolent system of payments not justified by inherent values. From the point of view of internal management, the co-operative associations and the stabilization corporation would need to operate as conservatively as a line-elevator company. A co-operative association, like any business organization, must make profits if it is to avoid losses and continue as a going concern. The legal distribution of profits is a question by itself; but it is far simpler than the distribution of losses. As a practical proposition in business, the only way in which a co-operative association can hope to excel independent merchants is to equal them in efficiency of management and excel them in volume of operations. If the profits to be secured through taking over the functions of middlemen are as large as anticipated by wheat growers, with assured prospect of building reserves, there will be little fear in facing operative losses; but one cannot be confident that such can actually be secured. After the first enthusiasm of the experiment is over, Congress would not be expected to tolerate inefficient management in a co-operative association operating with government funds.

It does not seem to us implied or contemplated in the Act that the co-operative

associations should draw their credits solely from the revolving fund of the Federal Farm Board. On the contrary, commercial credits ought to be freely used and the control of wheat marketing by the Farm Board would facilitate the granting and safeguarding of bank loans. This, however, might have some influence on the form of organization of the co-operative associations which should be constructed to make the widest use of, and afford the soundest security for, credits, howsoever derived. Under the Act, co-operative associations are not expressly responsible for losses sustained by the stabilization corporation, though apparently the Farm Board is not denied the power to exact such responsibility as condition for a loan.

Membership in the wheat growers' co-operative associations would be restricted to growers. The advisory commodity committee would be appointed by the regional co-operative associations, five of the seven members being growers, the remaining two being experienced handlers of wheat. The final wheat stabilization corporation, to be recognized by the Farm Board, would be the creation of the wheat growers' co-operative associations, and in this sense farmer-owned and controlled. But precisely how this stabilization corporation is to be brought into being farmer-owned and farmer-controlled, retain that character, remain responsible to the co-operatives, and at the same time act as the instrument of the Farm Board, represents an obviously difficult administrative problem that will not be easily solved. In just such questions will the judgment of the Farm Board be brought into play.

We take it that the recently proposed "Farmers' National Grain Corporation" is the beginning of a stabilization corporation under the new law. It is apparently a merger of small co-operative associations and farmer-controlled elevator companies. A merger of farmer-controlled elevator companies does not make a co-operative association. When the Canadian wheat pools were organized, two large farmer-owned elevator companies were in existence. One of these was taken into the co-operative movement, but the other continues to exist as an independent farmer-controlled marketing organization. The merging of small co-operative associations with farmer-owned elevators is of course a beginning, but it is only a beginning. Apparently it is sought, initially at least, to have the Farmers' National Grain Corporation handle coarse grains as well as bread grains. Despite the circumstance that coarse grains are handled in Canada by the wheat pools, regional conditions in this country are so different that we incline to the view that separate organizations will be found preferable. Because of regional differences, separate co-operative associations are indicated, but only one stabilization corporation. It will take time to organize representative co-operative associations, and this cannot be deferred, because it is difficult to contemplate having the stabilization corporation handle wheat in the absence of a growers' organization. Also, in such a case, the corporation would be handling largely non-member wheat instead of a controlling volume of member wheat plus more or less non-member wheat.

The Act contains no specific provision for the composition of the boards of directors of stabilization corporations, for which the laws of the state in which they are incorporated are to be controlling. A question of policy is sure to arise in this connection. The attempt will be made to have the prominent farm organizations represented in these corporations by having their officials placed on the boards of directors. The board of directors of a stabilization corporation will have intensive administrative tasks, and it is to be questioned whether it is in the interest of efficiency to have officials of farm organizations as members of boards of directors of stabilization corporations which function between the Farm Board on the one hand and co-operative associations on the other. The point is of administrative importance.

Continuity of Operation

It would be naïve to ignore the possibility that a Farm Board, entrusted with the inauguration of a new national policy, might have its deliberations somewhat influenced by considerations other than strictly economic ones. There is undeniably a psychology in the problem of farm distress and farm relief which makes it difficult to

anticipate sheer objectivity, at least in the initial period. Different members may evince tendencies to be radical or conservative, to view circumstances realistically or traditionally, to prefer the new way or the old way, to take risks or to avoid them. The history of the Interstate Commerce Commission, the Federal Trade Commission, the Federal Reserve Board, and the Shipping Board, illustrates what must be expected in the initial development of policy by the Farm Board. The Board will need to find itself, to feel its way, to be guided by trial and error, not merely because the development is experimental but also because social relations involved are in process of evolution. The legislative creation of the Farm Board is a beginning, the field is an opportunity, the technical procedure is an experiment, and the outcome is an expectancy.

The regional wheat growers' co-operative associations would resemble the provincial pools of the three Canadian Prairie Provinces, except for the important difference that the three Prairie Provinces of Canada grow the same type of wheat and harvest it at the same time. In a sense also the wheat stabilization corporation would resemble the central selling agency of the three provincial Canadian wheat pools. The agency operates continuously, on account of the large proportion of the wheat crop annually exported; continuous operation of the stabilization corporation might not be called for in the United States. We see no reason why the interior workings of the American regional wheat growers' associations, apart from their credit sources, should differ essentially from those of the provincial Canadian pools. The chief differences would grow out of the quasi-governmental status of the wheat stabilization corporation, since it would be directly responsible to a governmental board, as is not the case in Canada.

Since we interpret the Agricultural Marketing Act as incorporating a policy of merchandising rather than of price stabilization or direct price elevation, the procedures to be envisaged fall generally within the scope of measures with which wheat growers are already familiar. On the basis of available commercial experiences in the centralized marketing of agricultural commodities, it may seem indicated in some years for the operations to cover the entire crop, in other years to be confined to a part of the crop. Whether one operates with all wheats, or only with certain wheats, the available trading tactics are limited by the portability of wheat, the milling characteristics, and the supply of substitute cereals.

Some proponents of the stabilization procedures favor continuous operation; others would reserve the operation for emergencies. In the first case, the stabilization corporation would operate in each region after each harvest, act as merchant throughout the year, and control carryover in accordance with acreage and condition of the new crop. If the operation were reserved for emergencies, the stabilization corporation would operate only in the event of an exceptional supply, and withdraw when usual conditions became restored. Naturally, something would depend on the definitions of "usual," "exceptional," and "emergency." In short, the co-operative associations would operate continuously, but the stabilization corporation would operate continuously or intermittently, according to policy adopted. Wheat growers and grain traders during the progressive decline in the price of grains in the spring of 1929 assumed that with the passage of legislation the first thing to be done would be to organize a stabilization corporation to lift from the market the excessive carryover of grain. Even this expectation, however, did not contravene the view expressed above, since the carryover from 1928 into 1929, in relation to the world position, is exceptional. Since then the market has changed.

Both administratively and in matters of policy, the procedures in thus handling a wheat crop under a Farm Board fall naturally into two groups. The one contains the several functions in the handling and merchandising of the wheat passing into domestic consumption and in the routine sales of wheat passing to export. The other contains the procedures directly employed toward influence on price. Expanding or contracting the carryover, dealing in wheat futures, the impounding of wheat to be carried into the subsequent crop year, and the export dumping of wheat are the outstanding procedures available in this group.

Some would regard the first group of procedures as constituting the outstanding and continuing operations, the procedures under the second group being regarded as of such a nature as to be held in reserve for use under exceptional circumstances. Others, while laying no less stress on the direct importance of the procedures of the first group, regard the procedures of direct price influence as so continuously important for the objectives of the total operation as to require regularly their forceful application. According to this view, indeed, success with the co-operative procedures is contingent on success with the direct price-influencing procedures, and both sets of operations must be developed and applied. These differences in view imply not merely differences in scope of objective, but also a difference in appraisal of the probable effects of co-operation in the handling and merchandising of wheat instituted independently of operations designed to influence price. In our view, procedures of merchandising represent the basic and continuous operations.

General Aspects of Trading Tactics

The trading tactics available and desirable (except in the event of an extraordinary emergency) would represent a combination of country and terminal operations. These include: (*a*) guidance of shipment by member producers directly after the harvest of winter wheat and possibly also later after the harvest of spring wheat; (*b*) supplementary thereto, purchase of wheat from non-member producers directly after harvest (as of grades, varieties, and qualities in amounts and proportions that would vary from crop year to crop year); (*c*) centralized merchandising from country points to mills; (*d*) centralized merchandising at terminal points of primary country stocks acquired; (*e*) centralized merchandising of export wheat; (*f*) determination and control of the carryover (in toto and by regions, varieties, and grades, in varying amounts and proportions from crop year to crop year).

The objectives would be (employing loose terms of the markets) to create and maintain a seller's market, to heighten the buying competition between domestic mills, and to moderate the influence of export prices on domestic prices. Such a policy would result in the somewhat paradoxical endeavor to simulate the marketing circumstances of a short wheat crop under varying conditions of larger crops. To the extent that such a policy might be successful, it is hoped that the post-harvest depression of wheat price would be moderated without disturbing the subsequent recurring rise in price that ought to occur to cover carrying charges. Beyond this, short-term fluctuations would be restrained, long-time and long-distance influences on month-to-month variations reduced, and milling qualities better reflected in terminal values. In short, by creating the atmosphere of a seller's market, it would be sought to have conditions of domestic supply and demand determine largely the domestic price of wheat, with some restraint of the influence of world conditions of supply and demand on domestic price, at least whenever these were working in the downward direction. To make the best of a domestic situation would be one thing, and would demand one type of procedure; to make the best of an international situation would be a different thing and might involve a totally different type of procedure. This policy would depend in part on the definition of wheat surplus formulated by the Farm Board.

Relations to Grain Exchanges and Futures Trading

The experiences of the private grain trade of North America, Argentina, and Australia, of the Australian and especially of the Canadian wheat pools, and of the United States Grain Corporation, the Inter-Allied Wheat Executive, and the wheat boards of the several European countries during the war seem convincingly to be interpreted in the direction of one fundamental conclusion to be applied to the impending American innovation. The Farm Board will need to decide between continuation of exchange trading on the one hand, and monopoly with fixed price of wheat on the other; there is no middle ground, in consideration of the characteristics of the international wheat market, for which precedents are available. A rever-

sion to grain trading without grain exchanges is conceivable, but it cannot be regarded as practicable: if auction sales are to be avoided (such as exist in the case of wool but are unthinkable in the case of wheat), wheat producers must assume the risks of price variations, or manufacturers of the raw material will widen their spreads to take account of them. In the post-war development of international markets in raw materials, exchange trading has expanded; and despite all congressional agitation for the restriction of trading in futures on the grain exchanges, the practice has never been so well established as it is today. American grain traders are active on the international wheat market; and in view of the trend in the direction of exchange trading in Argentina and Australia (where it is conditioned by the slow introduction of bulk handling), it would seem the wise policy in the immediate future to make the best of the existing international system rather than to introduce drastic changes by substitution of direct trading for exchange trading in the United States.

Direct selling from producers to millers, at home and abroad, suggests an improvement in efficiency, and is supported by many who regard elimination of middlemen as equivalent to elimination of waste. It may come about through the natural process of evolution, but it is not a progress that lends itself to the tactics of revolution. So long as the wheat trade of the world is adjusted to price registration on grain exchanges, it would seem preferable to continue wheat trading in the United States on this basis, since otherwise a problem of price insurance will be directly created in attempting to introduce direct trading. In the short-term view—the view of a decade, let us say—there would seem to be no alternative between monopoly and exchange trading. Regarding continuation of exchange trading as inevitably indicated, for the time being, in our judgment the attitude of the Farm Board, the wheat stabilization corporation, and the wheat growers' co-operative associations should not be one of tacit adaptation, but should be one of active co-operation.

That simultaneous registry of price at home and abroad facilitates export and thus represents an advantage secured through trading in futures on grain exchanges is made obvious through comparisons between commodities traded on exchanges and those otherwise marketed. Barley, for example, has no futures market, and exports of barley in consequence are largely made on the basis of arbitration. Wool has no futures market and in consequence is commonly sold at auction. While price registry in the wheat pit permits a declining world price promptly to influence the domestic price in a corresponding direction, it also permits a rising world price as promptly to influence the domestic price in that direction.

It would be to no purpose at this time to undertake an appraisal of the services rendered to American agriculture by organized marketing on the grain exchanges. It is to be recognized that (*a*) public price registration, (*b*) the divesting of risk by country elevators, terminal grain merchants, and millers through hedging, (*c*) the assumption of risk by speculators through futures trading, and (*d*) the facilitation of bank credit thereby achieved are advantageous to wheat growers. At the same time, abuses have crept into the grain exchanges (or become more evident), particularly into the Chicago Board of Trade; and country grain dealers, terminal grain merchants, millers, and exporters have during recent years voiced emphatic protest against abusive practices. To certain perversive tendencies in the trading in grain futures, the Grain Futures Administration of the United States Department of Agriculture has given attention; and in the report of the President of the Chicago Board of Trade for the year 1925, cognizance was taken of those "who would take advantage of technical conditions and abuse the market for the sheer purpose of advancing their own selfish aims." Speculation depends on price fluctuations, but itself tends to moderate price movements. Nevertheless, it seems clear that under certain circumstances speculation may provoke price fluctuations.

The opponents of futures trading blame short selling especially for short-term declines; the proponents extol futures trading for sustaining prices over long periods. Conjoining these statements, the wheat grower makes the rejoinder that the de-

pressing effect of short selling is likely to occur directly after harvest when the wheat is being marketed from the farm, and the price-sustaining effect of long buying is likely to be most in evidence in the second half of the crop year, when the wheat is largely out of the hands of the producers and in the possession of middlemen. Also, wheat growers feel that since they run chances of selling their wheat on the bulges or on the breaks, they are thus forced into a speculation which is not of their choosing. What is wanted is retention of the advantages of trading in futures through what might be called "normal" speculation, with elimination of the disadvantages by the restraint of what may be called "abnormal" speculation. A doctrinnaire distinction between so-called "normal" and "abnormal" speculation in wheat futures probably no one could set up in words; but experienced traders are rarely at a loss to make the distinction.

Manipulation of Carryover

Whether the corporation undertakes to operate with all wheat, or to restrict the operations to high-grade wheats or to low-grade wheats (these to be considered later), two accessory implements available are manipulation of the carryover and so-called "export dumping" of wheat. In the discussions on farm relief it seems generally to have been taken for granted that, under varying circumstances, increasing the carryover into another year and "export dumping" of wheat would increase the price in a readily predictable manner. But this is hardly the case. Entering on such a program, the corporation will find few reliable precedents in large-scale operations. Even when economic theory is applied to the propositions, this will be conditioned by qualifications and by assumption of "other things equal." None of the experiences of the wheat boards set up during the war, and continuing directly afterward, are available as precedents. When the corporation carries a substantial proportion of a crop of wheat into the next crop year, i.e., an amount in excess of the natural carryover, or undertakes to clear out the domestic wheat bin by dumping abroad a substantial amount, in excess of the otherwise export, the Board will be conducting experiments. Let us consider some of the variables in the experiments.

Suppose the growers' price is viewed as unsatisfactory, and the Board contemplates withdrawing from the market of the present crop year a substantial amount of wheat for the purpose of elevating the domestic farm price during the current crop year, directly by the effect of such withdrawal on the domestic price, also indirectly possibly by the effect upon the world price. At the same time, the Farm Board must envisage some reduction in the otherwise price of wheat in the coming crop year, both abroad and at home, in consequence of the addition to the wheat supply of the coming year, of the wheat withdrawn from the supply of the present year. There will be expense attending carrying the wheat. Withdrawing wheat from this year's supply and adding it to next year's, with consequent effects on prices during the current year and the next year, at home and abroad, may result in changes in production and consumption, at home and abroad.

How, now, may the corporation compute the amount of wheat to be carried over under the circumstances, estimate the price-raising effect during the present crop year and the price-lowering effect during the next crop year, and appraise the expenses and possible losses of the operation? The problem is in fact an extremely difficult one. The expense of carrying the wheat would be the easiest part of the computation. Beyond that, lacking precedents, the Board would have little else to fall back on for guidance than arbitrary computations applied to past years. Taking crops, movements, and prices as they were in past years, on the basis of certain assumptions the Board could compute price influences to be expected from stated withdrawals of wheat from the market, stated expansions or contractions of the carryover, stated expeditions of wheat into export. There would need to be a great deal of "other things equal" in such computations. Even in years of relatively unchanging world wheat price level, such computations would hardly lead to explicit indications. The domestic price level can hardly be raised notably by any change of marketing short of taking so much off the market as to simulate a short crop.

But in most years the price level of wheat in the forthcoming crop year would be higher or lower than in the present crop year, rather than unchanged. If, owing to changes in supply and demand (largely on the side of supply) in the world, the wheat price level in the forthcoming year were to rise, then the price-reducing influence of the wheat carried from the old-crop year into the new-crop year would be minimized. In consequence, the agency carrying the wheat would lose less money, or might make money, on the transaction. Also, the value of the new crop would be increased. If the domestic crop were abundant in a crop year when the world crop was short, the import markets would tend to absorb the wheat carried over as well as the new exportable surplus, so that the net effect of the operation would be more or less strongly plus for the two years. This of course merely proves what the trade has always known, that a carryover from a long to a short year is profitable, provided the increase of price in the new year is large enough, and the quality of the old crop is good enough.

On the other hand, if relations between supply and demand in the new-crop year (especially on the side of supply) were such as to provoke a decline in the world price level, with consequent decline in the domestic price, the wheat carried over would enter a market lower than that from which it had been withdrawn, with the expense of carrying to make the situation worse. The carrying agency would have heavy direct losses; also, the loss on the farm price in the second crop year would outweigh the gain in farm price in the first crop year. The carrying agency would then have to decide between disposing of the carryover at a direct loss or storing the wheat for another year. But the prospect of gain in storing wheat for two years is less than in storing it for one year.

The gist of the dilemma would seem to be that there is prospect for profit to wheat growers in carrying wheat from one crop year to the next only when one operates into a rising market. In other words, it becomes a speculation in the wheat price level of the world during the coming year. Only under such circumstances (in view of the relation of the exportable surplus of the American crop to the total volume of the American crop, to the total of the world crop, and to the total volume of exporters' surpluses) is there a dependable prospect that improvement in the farm price of wheat, consequent on the withdrawal of part of the domestic supply for addition to the next crop year's supply, will outweigh the depressing effect of the wheat carried over on the crop of the new year. Whether secret operations would have other effect than open operations need not be here considered.

Indeed, plausible reasons may be advanced for the view that a corporation would enjoy better prospects for increasing the farm price of wheat by employing just the opposite tactics. Instead of withdrawing wheat from a large crop and carrying it into the next crop year, it might prove better to withdraw wheat from a short crop and carry it into the next crop year. For wheat-exporting countries in the position of Canada, Australia, and Argentina, this could hardly be recommended; but in the United States, behind the tariff wall, the prospect would prove attractive. It would require a large amount of wheat to be withdrawn from a large crop to affect the current domestic price substantially; also, a large amount projected into the next crop would tend to depress its price substantially. But a small amount taken from a small domestic crop would influence the domestic price disproportionately, behind the tariff wall; also, a small amount added to the new crop would tend to depress its price but slightly. Naturally, such tactics would have to take careful account of conditions both in the world and in the domestic market. But in a country tending to approach the domestic basis, with a high tariff on wheat, probably the domestic price could be influenced more by making a short crop shorter than by making a long crop less long. The success of such a policy would be much enhanced if in addition to the flat duty on wheat there were also a differential rising scale, based on rising protein content. The amount of money required in this policy would be small. Such a practice could not of course be classified as stabilization, but precisely the reverse. It would be an outright monopolistic procedure of price raising.

Export Dumping[1]

Carrying wheat from crop year to crop year might be termed a domestic device, to be judged on the basis of returns to wheat growers. In the case of "export dumping" of wheat, however, other phases enter than purely domestic considerations. Possibly the simplest aspect of the dumping of wheat into export is the question of the effect on price. In the nature of the commodity and of the circumstances attending the marketing of wheat, we take it that export dumping of wheat could be counted on to influence domestic wheat price much more than carrying wheat from crop year to crop year. There has been a great deal of discussion, in international circles, of dumping; and it seems clear, in general, that the dumping of exportable surpluses tends to be effective in raising domestic prices. Considered merely as a method of reducing the domestic supply, export dumping would lend itself peculiarly well to the marketing situation of the United States because of the large proportion of substandard wheats in our crop, wheats unfitted to meet American consumers' standards. These substandard wheats are readily salable in various export markets,[2] but only at notably low prices. From every point of view, domestically and internationally, the dumping of wheat would tend to contribute a better psychological effect on the wheat market than carrying wheat over from one crop year to the next; in the one case the wheat disappears, in the other case it is merely hidden and the storing country goes through the motions of trying to deceive the market.

The difficulties of such export dumping lie largely outside of the question of effectiveness of the procedure. In the first place, export dumping implies more or less continuous annual direct losses, often of heavy dimensions. Presumably the dumping would be done by the wheat stabilization corporation, not by the wheat growers' co-operative associations. In time, a reserve fund ought to be accumulated, out of which export losses would be paid.[3] Initially, export losses would stand as a sort of overdraft against the revolving fund. But it was not the intention of the Congress that losses on export should be definitively paid for out of public funds; a policy of export dumping would need to include some not yet projected scheme for prorating of losses back upon the wheat growers' co-operative associations, in proportion as the different regions participated in the exports. We hold this view, despite the language of the Act being interpreted to the contrary.

Second, export dumping may involve international complications. This would presumably not be the case in so far as the superfluous wheats were dumped into countries that do not raise wheat, or where bread grains are not extensively grown. Thus, export wheat, or flour, might be dumped into the Philippines, Japan, China, the East Indies, the Straits Settlements, the West Indies, and Central American countries, without provoking reprisals, countervailing duties, or other untoward reactions. But dumping wheat in Europe might easily provoke reprisals.[4] Fear of reprisals is an additional reason why the losses on export dumping must be borne by the producers and not by the public treasury.

It seems obvious that export dumping hardly lends itself to price "stabilization," but is instead adapted to price elevation. To resort to export dumping and to carry wheat from one crop year to another for the purpose of smoothing out the price of wheat throughout the crop year looks like shooting at a small target with large artillery. After years of experience, a corporation might judiciously carry over a small amount of a particular wheat or judiciously dump a small amount of a particular wheat abroad, in order to prevent the price of one wheat from displaying an untoward variation not involving the other wheats. But broadly considered, carrying wheat from one crop year to the next or longer, and export dumping of wheat, are designed for elevation of domestic price level rather than for price stabilization.

The foregoing discussion again serves to bring into contrast the different objectives inherently implied under stabilization and

[1] We use the term "export dumping" in the loose vernacular sense. It is not an exact expression and has no uniform international usage. We shall later consider the topic in some detail (see pp. 414–15).

[2] Partly in competition with rice, but more in competition with coarse grains and legumes.

[3] See, however, pp. 379–80.

[4] Cf. "The Export Debenture Plan for Wheat," Wheat Studies, July 1929, V, 336–41.

elevation of wheat price, and indicate how profoundly the procedures of the Farm Board will be modified in accordance with election of the objective. It is not going too far to suggest that a consistent merchandising policy might be based upon one or the other objective, but could include both only with additional complications. Of course, merchandising might include neither. There is some overlapping of objectives and obviously also of procedures in any case; but consistency in the main trend of operations would necessitate a definite delimitation of objectives.

Price Insurance

Section 11 of the Act authorizes the Board to cause to be issued policies of insurance to protect co-operative associations against "loss through price decline in the agricultural commodity handled by the associations and produced by the members thereof." Such insurance is offered only to the co-operative associations, not to the stabilization corporation. Premiums on the insurance policies would be paid by the association and would be placed in an insurance fund. In the event of loss under the price insurance policy, such loss would first be paid out of the insurance fund and thereafter out of the revolving fund, in the nature of a loan with interest to be later repaid from insurance premiums. In effect, therefore, a loan out of the revolving fund would be a loan to the insurance fund of the co-operative association and not to the co-operative association itself. Whether the association has or has not borrowed from the revolving fund for other purposes, has no effect upon the issuance of an insurance policy. It is provided that the co-operative association shall first seek insurance from private agencies, that insurance can be issued only in the event of public registration of price of the commodity, and that it shall not operate unduly to enhance prices or unduly to enlarge the surplus. And records must be available over a period of years upon which risk and premium may be calculated; insurance must rest upon a demonstrated actuarial basis.

We doubt whether insurance will be applied for to cover the price of wheat, or would be granted if applied for. But it is worth while to point out that the operations of the stabilization corporation would be different if the co-operative associations had price insurance than without it. Also, it is interesting to note that price insurance could cover only member wheat and not non-member wheat.

The Profit and Loss Account

We take it the stabilization corporation and the wheat growers' co-operative associations would enjoy three sources of credit, alternative or supplementary. The first is the revolving fund of the Farm Board. The second is the Intermediate Credit fund. The third is the commercial banks. Naturally, emphasis has been laid upon the revolving fund; but we take it that as the wheat stabilization corporation and the regional wheat growers' co-operative associations develop, credit from the intermediate credit banks and banking accommodation of a strictly commercial character will become more and more prominent. Indeed, with the success of the undertaking and the establishment of proper reserves, it ought to become possible to dispense with the use of the revolving fund except in special emergencies, or to resort to it much in the same way as member banks borrow from the Federal Reserve Banks.

Previous legislation had already provided seemingly adequate credit facilities for agriculture, especially to individuals. We take it to have been the intention of the Congress in the new legislation to provide not merely supplementary and perhaps cheaper credit to co-operative associations, but rather to make available additional funds for special purposes after full use has been made of existing credit facilities. It can hardly have been the intent of the Congress to have the revolving fund of the Farm Board compete with other agencies for the business of providing banking accommodations to agriculture. In other words, we take it that co-operative associations ought first to make all available use of existing credit facilities before approaching the Farm Board for loans from the revolving fund. It is hardly to be urged that existing credit facilities have been exhausted; indeed, it seems clear that the pro-

visions of the Agricultural Marketing Act will operate indirectly to expand the volume of commercial credit available to agriculture by regularizing marketing operations and making them safer.[1]

The intent of the Congress in respect to profits and losses may be taken as revealed in the Act. In what follows we endeavor to draw for the Agricultural Marketing Act a realistic rather than a legalistic interpretation. The provisions for loans to co-operative associations are separated from the provisions for loans to stabilization corporations.

Wheat growers' co-operative associations, upon such terms for security and other reservations as the Board may impose (including a reservation against undue production of surplus in excess of annual marketing requirements), may borrow money from the revolving fund for five purposes: (1) to aid in effective merchandising; (2) to lease or purchase physical marketing facilities; (3) to support the formation of clearing house associations; (4) to extend the membership of the co-operative association; (5) to enable an enlarged initial payment to be made to members on delivery of wheat. The granting of loans for lease and acquisition of physical marketing facilities is strictly limited. There is no stated provision for disposition of losses by co-operative associations. Presumably, therefore, the Board could fix upon the co-operative associations or assume for itself such losses as might be incurred, so long as the terms were not inconsistent with the provisions and purposes of the Act. We take it that in respect of management of profit and losses, the provisions of the Capper-Volstead act would continue to apply. It is to be observed that co-operative associations are not accorded the right of borrowing from the revolving fund for the purpose of handling or control of surplus. But there is nothing in the Act to prevent a wheat growers' co-operative association from employing commercial credits in the handling of surplus wheat.

The provisions for loans to the stabilization corporation make distinction between loans authorized for use in marketing operations and those to be used "for the purpose of controlling any surplus in the commodity in furtherance of the policy declared in section 1." For both subdivisions of the stabilization corporation provisions are set up for building reserves out of profits. For both classes of loans to the stabilization corporation the Board is granted wide powers to control the uses of, and to establish security for, the credit. Losses sustained by the stabilization corporation in merchandising operations cannot be passed back to shareholders by assessment but must be paid out of reserves accumulated from previous profits or stand like an overdraft or lien against reserves to be accumulated out of future profits. Such losses would stand against that subdivision of the stabilization corporation until paid and could only revert to the revolving fund in the event of insolvency and dissolution of the corporation. In short, in respect to loans to the wheat stabilization corporation for merchandising purposes, the revolving fund remains a revolving fund and is not to be used as a coverage fund.

In respect to losses that might be incurred by the wheat stabilization corporation in controlling the surplus, these are segregated and are to be paid out of profits secured through controlling the surplus or will be paid, if such accumulated profits are not available, by a special loan from the revolving fund for that purpose. Reserves and profits secured through merchandising operations cannot be used to cover losses incurred in controlling the surplus. Losses incurred in controlling the surplus cannot be assessed against shareholders of the stabilization corporation. If a wheat stabilization corporation should incur loss in controlling the surplus and never previously or subsequently through controlling the surplus made profit enough to repay the loss, this would remain as a surplus-loss-loan and might eventually be-

[1] Hedging has two attributes: insurance of price and facilitation of credit. In a sense, since the price insurance of hedging is not complete, the facilitation of credit is quite as important as the price insurance. When wheat is hedged, commercial bank credit is freely available and the cost is relatively low. If, now, the wheat of co-operative associations is not hedged, it becomes less available as security for bank loans. This difference must be made up by the support of the revolving fund; the stabilization corporation must in some way contribute to banking accommodation that support which hedging now contributes. At the same time, it is clear that speculation must be retained in order to support the hedging of non-member wheat.

come a dead loss to the revolving fund. To this extent the revolving fund might become a coverage fund rather than a true revolving fund.

It is important to observe that under the Act it might develop that the wheat growers' co-operative associations, using borrowed money from the revolving fund, were making profits and building reserves and that the wheat stabilization corporation, with money borrowed from the revolving fund, was making profits out of merchandising operations and building reserves, while the same wheat stabilization corporation, with money borrowed from the revolving fund for control of surplus, had lost money and was in arrears. In such a contingency, the loss incurred in controlling the surplus could not be paid from the profits and reserves secured through merchandising operations on the part of the stabilization corporation or the wheat co-operative associations. In short, the co-operative associations and the merchandising branch of the stabilization corporation might be solvent and even prosperous, while the surplus control branch of the stabilization corporation might be in arrears and even insolvent.

Two observations are to be emphasized. In the first place, such a delimitation between merchandising wheat and controlling the surplus of wheat as seems implied in the Act does not in fact exist. Secondly, the powers and discretion vested in the Farm Board would enable it to make such stipulations in respect to loans to be used in controlling the surplus as would in all probability nullify the risk of having the revolving fund used as a coverage fund, since in the final analysis it is the Farm Board and not the wheat stabilization corporation which would determine whether and how a particular wheat surplus were to be controlled. The Farm Board has power, in respect to loans, to exact stipulations that are not imposed upon the Board in the Act.

We take it to be the intent of Congress that the till of the government should be used for working credit and not for liquidation of losses. While zealous co-operative agriculturists may not always approach the Farm Board with full realization of the distinction, we may expect the Farm Board to grant applications for loans for controlling the surplus with such reservations as may be necessary to fulfil the intent of the Act.

At the same time, it seems clear that the Farm Board might not always be in position to exact from the stabilization corporation such security for a loan to be used in controlling the surplus as might be inherently desirable. With commercial banks, the intermediate credit system, and the Farm Board all participating in agricultural credits, it seems possible that the simpler operations would fall to the first two, and with them the better security, while the more difficult operations would fall to the Farm Board, and with them the lesser security. This would be the more certain if the freest use is to be made of conventional banking accommodation and the revolving fund restrained from growing to unwieldy dimensions. It seems clear also that agricultural credit from the several sources should be co-ordinated and not become competitive.

Wheat growers seem convinced that the co-operative marketing of wheat would bring to them a larger proportion of the dollar spent by consumers for wheaten products. If regional wheat growers' co-operative associations could take over the business of the so-called middlemen, i.e., grain merchants, and thus secure the same net profits that now accrue to the grain traders, these sums might be used to build up an operative fund and later a reserve fund which would make the co-operative associations independent of governmental assistance. The experience of the wheat pools of the Prairie Provinces of Canada is pointed to as proof of the inherent feasibility and practicability of this policy.

But even if this should eventuate, time would be required. Even if regional co-operative associations could be set up to handle the crop of 1930, under the most favorable circumstances the predicated accumulation of operative and reserve funds would require several years for accomplishment, as shown by the experiences of the Canadian pools. In the interval, the wheat growers' co-operative associations and the wheat stabilization corporation could hardly operate except with use of the governmental revolving fund.

Under these circumstances, we take it that the stabilization corporation would adopt the policy of paying its way. The corporation would not contemplate passing losses back to the government nor yet aim merely to avoid operative losses; it would aim to make profits. This was the aim of the United States Grain Corporation during the war, of the Commission for Relief in Belgium, of the (British) Royal Commission on Wheat Supplies, of the wheat controls of Australia, Argentina, and Canada during the war. Not all of these organizations made profits in their operations. But they were all run for profits, not because they had direct uses for the profits but because the surest way of avoiding losses is to strive for profits, just as the best defense is a good offense. Therefore, we take it that the co-operative association, responsible at once to the Farm Board and to wheat growers, would establish its policy of operations on the plane of making profits. And the Farm Board and the wheat stabilization corporation, though operating under broad powers, would, we gather, adopt the view of the profit and loss account of a going commercial concern.

Opinions vary as to the commercial outlook for the stabilization corporation. Rather oddly, farm economists seem to have little faith in the profitable outcome of the corporation's dealings, while experienced grain traders incline to the view that a properly managed corporation ought to make profits. Traders who hold this view, however, do so only in respect to merchandising operations, not to surplus control. No one expects the wheat stabilization corporation to make profits out of surplus control except in the event of a windfall. The indirect profits of surplus control, the effect on domestic prices, are anticipated with far less confidence by the grain traders than by the farm economists.

If this appraisal of the situation be correct, a conservative management would seem implied. It will soon be determined how large are what could be termed the middlemen's profits of the co-operative associations. The consideration of the profit and loss account would influence the buying, storing, carrying, and selling policies of the corporation, also its attitude toward trading in futures. A conservative policy will result in setting up a super-merchant in wheat, which is what the central selling agency of the Canadian wheat pools is today. With expert management and in control of a large volume of wheat, a centralized merchandising agency would be able to take the best price advantages of varying situations and avoid dangers that would overwhelm an independent dealer. A centralized merchandising policy, unconservatively managed, especially as to control of surplus, might under exceptional circumstances bring it about that the stabilization corporation would be "holding the bag" for the wheat of the world.

The more one regards the profit and loss account, the more one is impelled to the conviction that it will represent not merely the end of the Farm Board's operation but also the beginning of it. That is, the policy on profit and loss will determine policy on operations. It is particularly from this point of view that the composition of the membership of the Farm Board is significant.

IV. COSTS AND PROFITS IN CARRYING WHEAT

The Possible Gain in Carrying Wheat

The holding movement has been prominent among grain growers for a half century. Decades ago, agitation for public warehouses was based in part on the need of grain growers for leasing space in which to hold their crops for better prices. Behind successive acts aiming to provide increased credit facilities for farmers, stood the need of credit to enable growers to hold their grains for better prices. Regulations on elevators in the central states were made with this contingency in mind; and one of the motives for the organization of farmer elevator companies was to enable the members to hold their grain for better prices. The wheat growers' co-operative associations and the stabilization corporation now fall heir to the holding movement and must use it or discard it. As we have seen,[1] the Agricultural Marketing Act implies, among

[1] See above, p. 360.

other things but presumably subordinate to them, stabilization of wheat prices within the crop year—moderation of the alleged post-harvest decline in price, without disturbance of the recurring seasonal price advance.

In the theory of the marketing of a transportable and (relatively) imperishable commodity which is seasonally produced and continuously consumed, the price is assumed to rise month by month, other things equal, by enough to cover the inclusive carrying costs. Other things being equal, the price of wheat toward the end of the crop year ought to be as much above the price of wheat at the beginning of that crop year as to cover gross carrying expenses.

Among wheat growers reigns the widespread conviction that grain traders secure large profits by buying wheat (the physical wheat) in the fall and selling it in the spring. To put the matter more succinctly, it is urged that heavy marketing during the autumn, under existing circumstances in the markets and grain exchanges, results in an undue relative depression of price during the first half of the crop year, and one not compensated for by a corresponding elevation of price during the second half of the crop year. Further, it is contended that the depressed price during the first half of the crop year falls on the grower, while the elevated price during the second half of the crop year accrues to the trade. By selling in the autumn, the grower has relieved himself of the risk of carrying the wheat; through the system of trading in futures, the grain trade that has come into possession of the wheat has protected itself against risk by hedging. If wheat growers' co-operative associations, or a stabilization corporation, replacing the grain trade, were to carry the wheat for growers' account, whatever profit accrued from the operation would be added to the weighted farm price of wheat.

To this the grain trade makes the rejoinder that as a rule there is no such net profit in buying cash wheat in the fall, carrying it through the winter, and selling it in the spring. If there were no trading in futures, on account of risk the price change from fall to spring would tend to be wider than it is now, as is known from the experiences of other countries; with risk moderated through trading in wheat futures and the associated hedging, the recurring seasonal price advance tends to be restricted to actual carrying charges, other things being equal. The argument that the grain trade depresses prices in the fall, when farmers are marketing heavily, and raises prices in the spring, after the bulk of the crop is in the hands of dealers, appears unsustained when considered in the light of actual trade practice. All large dealers routinely hedge purchases. Having bought wheat, they have nothing to gain from a rise in the general wheat price level. About the only persons involved who might be benefited by a rise in prices from fall to spring are the farmers who store wheat, an insignificant group of small country elevators that carry wheat unhedged, and those speculators who buy futures in the fall. Speculators, however, are free either to buy or sell at any time, quite without regard to harvest seasons. There is no common interest among speculators in having prices low at one particular season and high at another.

In order to hold an opinion on this subject, it is necessary to evaluate approximately the effective costs of carrying wheat on the farm and in country elevators and in terminal elevators. Once the expenses of carrying wheat in the several positions are known, these may be contrasted with the changes in wheat prices representing the recurring seasonal price movement. Finally, the theory of the carrying charge in the marketing of wheat must be contrasted with the current terminal practice. When all this has been done, it will be possible to form an estimate of the prospect of profits, if, as, and when the seasonal carrying of wheat now conducted by the grain trade is taken over by a co-operative association or the stabilization corporation. Carrying wheat from one crop year to another involves considerations widely different from those concerned in carrying wheat from the harvest over the winter; we are concerned in this section only with the problem of carrying wheat within the crop year.

About the only practicable method of determining whether, as a historical fact, the cost of carrying wheat exceeds the seasonal price advance is to measure statistically the

average actual change in price between fall and spring in each of a series of years, and to set against it the average annual cost of carrying wheat for the same period, so far as one can ascertain what this cost is. This procedure is subject to a considerable range of error in view of the data which must be used.

Three qualifications are of special importance. First, comparisons must be confined to price series applicable to identical wheats—wheats of the same variety, grade, and milling classification within the grade; otherwise premiums and discounts will be disconcertingly introduced into the calculation. But price series clearly applicable to identical grades of wheat are difficult to secure for a long period of time. Second, the measurement of average price change from fall to spring cannot be precise in its meaning; for, historically, price movements within each crop year may be other than seasonal in nature. Ideally, the wheat price level should remain unchanged from year to year in order that fall-to-spring changes in price should reflect only the seasonal price movement. But in fact the price level changes. Third, the available data do not admit of anything like precise measurement of the cost of carrying wheat either in elevators or on farms. Nevertheless one may reach significant conclusions on the matter of carrying costs and seasonal price advance, with due regard for the qualifications stated.

Another difficulty in appraising the intraseasonal spread of wheat prices lies in the literal and schematic formulation of the question. The wheat grower inquires what would be his farm price of wheat, as compared with the price under the present rate of marketing, if the wheat were marketed evenly throughout the crop year. Or, more specifically, if each wheat grower held back a portion of his crop until spring, what would be the net effect on his farm price, following adjustment for inclusive carrying charges? Strictly construed, the answer to these questions is not to be found in a comparison of wheat prices throughout the year. The comparison of wheat prices in the fall and in the spring is really the beginning of the discussion and not the end. It is strange how few reports of results of actual carrying operations are available.

The Cost of Carrying Wheat in Terminals

The Federal Trade Commission conducted an extensive investigation of the expense of carrying grain in terminals before the war.[1] One defect in their findings lies in the fact that their estimates were almost always too high. Quoted rates, rather than the rates actually applied, constituted the basis of the inquiry. Or, put in another way, the findings of the Federal Trade Commission were based on published or formal charges, not on current and effective charges. The effective charges over the period of the investigation of the Federal Trade Commission were always lower than the formal charges, though varyingly lower from season to season. In any event the findings of the pre-war investigation do not well apply to present conditions. Without going into an exhaustive investigation, it is possible to indicate the range of gross carrying charges in the principal markets at present.[2]

The initial elevator charge is for receiving the wheat and later loading it out, including a stated number of days' storage. The formal rate for this service is 1 cent per bushel in Kansas City and St. Louis and 1.25 cents in Chicago with ten days' storage, and 1.5 cents in Minneapolis with fifteen days' storage. Then comes the rate for continuing storage, which is 1/20 of a cent per bushel per day in Chicago and St. Louis, 1/25 of a cent in Kansas City, and 1/30 of a cent in Minneapolis. Thus, the formal elevator charge for storing wheat 260 days is 13.75 cents per bushel in Chicago, 13.5 cents per bushel in St. Louis, 11.0 cents per bushel in Kansas City, and 9.7 cents per bushel in Minneapolis. Elevators are not permitted to exceed the published rates but may reduce them, provided the reduced rates apply to all grain in store. In some years, with high volume of storage, the operation of terminal elevators is profitable; in other years, with low volume, the returns are unprofitable.

Practically all grain is stored on borrowed money. The bank loans on hedged wheat lying in elevators in terminal cities

[1] Federal Trade Commission, *Terminal Grain Marketing* (Report . . . . on the Grain Trade, Vol. 3), 1922.

[2] Cf. "Variations in Wheat Prices," Wheat Studies, June 1929, V, 241–300.

represent credit accommodations secured by liquid collateral, usually at the going rate of interest on prime commercial paper. Rarely is it below 5 per cent or over 7 per cent; perhaps most often it varies from 5.5 to 6 per cent. The amount borrowed varies with the price level of the wheat.

Insurance represents a highly variable item of expense. Terminal elevators range all the way from antiquated inflammable wooden structures to almost fireproof modern concrete silos. Some are protected with every device against fire and dust explosion; others have inadequate equipment or none at all. Kansas City is a more modern terminal point than Minneapolis, St. Louis, or Chicago; there the Board of Trade has established a fixed rate of insurance against fire, explosion, lightning, and tornado at 40 cents per thousand bushels per month. In the other large terminal cities the insurance rates vary from as low as 20 cents to $2.50 per $100 per year, depending on the fire hazard of the particular elevator. An average rate in Chicago is $1.80 per $100 per year, with a higher rate for shorter periods. Other things being equal, storage in modern concrete elevators is preferred, but circumstances often dictate a different choice. When wheat is delivered on future contracts, other things equal, this tends to be done from elevators with high insurance rates.

To what extent particular grain merchants secure bank loans or insurance at reductions below the going rates is not known. At times, heavy and continuous borrowers secure lower interest rates, and insurance rates also may be shaded under certain circumstances. No one is in position to know, in any year for any terminal city, the weighted expense per bushel per unit of time included under interest and insurance to cover the storage of wheat.

Since no estimates are available for the weighted elevator charges per bushel per unit of time or for the weighted interest and insurance charges per bushel and per unit of time, in any year in any terminal market, on the books of the grain merchants, it follows that the gross cost of carrying wheat in terminals is represented by a range, within which the elevator charges and the interest and insurance charges vary. But it is certain that the effective gross carrying charge assessed against the wheat is always less than the formal charge based upon published and going rates, and often much lower. The elevator rate is really fixed for each transaction, when the elevator man stores his own wheat, by the outcome of the deal.

From all this it follows that if one wishes to compare the cost of carrying wheat in terminal markets from fall to spring with the recurring seasonal price movement of wheat, one must do so, crop year by crop year, on the basis of actual carrying expenses, as determined from the books of elevators and grain merchants. The comparison cannot be made between quotations of formal and published charges and the observed recurring seasonal price change. Such a comparison tends to give a result somewhat exaggerating the figure for cost of carrying wheat. An elevator man may allot his wheat storage space for next to nothing in order to make money out of it in merchandising transactions. The real question is: could an outsider buy contract wheat, store it at regular rates and sell it later at a net profit? Usually he could not.[1]

Cost of Carrying Wheat in the Country

Any attempt to estimate the cost of carrying wheat in country elevators encounters particular difficulties, some of a regional character. Country storage is commonly said to be cheaper than terminal storage. In the estimate of cost of terminal storage, shall one select Chicago with high rates or Minneapolis with much lower rates? If one undertakes to set up averages of many terminal cities, shall this be by regions or country-wide? As the basis for estimate of country storage, shall one use the relatively expensive elevators of the older wheat regions or the relatively inexpensive elevators of the newer regions? The rates for elevator services, varying from state to state, are for the most part regulated. Storage rates in country elevators are sometimes changed, varying

[1] J. E. Pope, "The Holding Movement in Agriculture," *Economic Essays Contributed in Honor of John Bates Clark*, edited by Jacob H. Hollander (New York, Macmillan, 1927), pp. 242–82; also, *Quarterly Journal of Economics*, 1916, XXX, 805–31.

with the wheat crops of the locality and with the crops of other grains. In general, interest rates are higher for country elevators than at terminal points and variations between rates for different borrowers are more pronounced. Insurance rates vary widely, though probably no more than between terminal elevators. Despite the commonly reiterated view to the contrary, we are not convinced that the complete country storage charges for carrying wheat from fall to spring are materially lower than the effective terminal carrying charges. In any event, the comparison ought to be made by regions and the relations would vary from crop year to crop year. It might well eventuate that in some regions, or states, actual terminal storage is cheaper than actual country storage; also, the relations might change from one year to another. Country storage ought to be cheaper.

Estimates of the cost of storing wheat on the farm involve stipulations on farm accounting. In order to exclude losses by destructive animals and by infestation with insects, storage bins must be well constructed. Frequently, the farm has no need for storage space for other grain than wheat. Shall the cost of the storage structure be amortized over a period of years and interest on investment, taxes, and a charge for depreciation and upkeep be included in the accounting? Or shall the storage structures be regarded as a part of the general farm equipment and receive no attention in the accounting of the expense of storing the wheat? When wheat is harvested from the shock or stack, it is usually dry enough to be stored safely; but when harvested by the harvester-thresher, it is often so moist as to run the risk of heating and bin-burning. Experiences with the harvester-thresher suggest that it is highly desirable for farms to be equipped to clean the wheat and if necessary to condition it to prevent bin-burning.[1] Such equipment, like the threshing implements, could be cooperatively installed; but in any event it would constitute a charge against the stored wheat. Should interest be charged in the accounting if the wheat grower borrows no money on the stored wheat or only to the extent that money is actually borrowed on the stored wheat? A charge for insurance would apply if the wheat were insured; should an insurance item be entered if the wheat is not covered by insurance policy? The answers to be made to these several questions, from the standpoint of farm accounting, will determine the estimates of cost of farm storage.[2] If one assumes that it is all the same to the wheat grower whether, at his risk, he hauls his wheat out the week after it is harvested or hauls it out six months later, then the estimate of cost of farm storage will be very low. But if one pictures the farmer as wheat grower storing the wheat with his other self as farm elevator man, and attempts to itemize the expenses just as would be necessary if the wheat were commercially stored in the elevator in the neighboring town, the costs of storage would be relatively high. If a co-operative takes possession of the wheat of a member and stores it on the farm of the grower, then certainly all the commercial charges and risks must find expression in the accounting of the co-operative association. As a matter of experience, the losses attending storage on the farm are apt to be considerable. For illustration, a considerable proportion of the wheat of the 1928 crop stored over the winter on Kansas farms is known to have deteriorated. Unlike corn, wheat does not naturally tend to improve in grade on storage.

Whatever the practice of the individual wheat grower storing his grain in respect to depreciation, upkeep, interest, and insurance, a wheat growers' co-operative association would need to give a strict accounting to these items. If wheat growers were urged to restrain the rate of marketing wheat and store it on the farm, the growers' services to the association should be compensated. In effect, the co-operative association may be regarded as taking possession of the wheat when it is harvested and the inclusive expenses of country storage would accrue against the co-operative association, to be paid to the grower or to someone else, and the disposition of the wheat would be at the command of the

[1] Cf. H. M. Bainer, *More Farm Storage for Wheat* (The Southwestern Wheat Improvement Association, Kansas City, 1929).

[2] Cf. R. M. Green, *Farm Storage as a Factor in the Marketing of Kansas Wheat* (Kansas Agricultural Experiment Station Bulletin No. 229), November 1922, and J. E. Pope, *op. cit.*

association. We take it that if this view of the farm storage of wheat of members of the co-operative association were to be adopted, a strict accounting of expenses of storage would be developed and the operation no longer merged in the general conduct of the farm.

The use of the harvester-thresher combine has greatly changed the scope and the meaning of farm storage of wheat. When wheat was threshed after drying in the shock or stack, it could be stored without risk in any vermin-proof space on the farm. Under these circumstances, the cost of storage was low and there was some justification for declining to charge against such storage interest and upkeep on the buildings in which the wheat was stored because these could and did serve other purposes than storage of wheat. But when wheat is harvested with the combine and the implement employed at its lowest cost, it is desirable to clean the wheat on the farm and to store it in self-ventilating bins. These self-ventilating bins serve no other purpose than the storage of wheat threshed moist from the harvest, and a charge for interest and upkeep must therefore be placed against the storage. The increased cost of storing wheat with combine harvesting must be subtracted from the heavy saving in threshing costs otherwise secured through the use of the combine.

Farm storage of wheat is perhaps less to be recommended on grounds of marketing than on grounds of farm management, since cleaning and storage in ventilating bins on the farm alone permit of the utilization of the potential economies in the use of the harvester-thresher combine. Also, farm storage relieves pressure on terminal storage, a matter of importance in connection with velocity of farm marketing consequent upon the use of the combine. The general recommendation that wheat be cleaned of dockage on the farm and the dockage used as feed must be supplemented with instructions to destroy the viability of weed seeds in the dockage either by grinding or cooking; otherwise increasing the farm use of dockage for feed will intensify infestation of the fields with weeds.

Under these circumstances, when widespread transactions in the storage of wheat come to be undertaken by co-operative association or stabilization corporation operating under the Farm Board, it will be found that the data necessary to determine the costs of farm storage of wheat, in guidance to the association, are not available. Therefore, when the question arises whether the cost of storing wheat on the farm from fall to spring is higher or lower than the recurring seasonal movement in the farm price of wheat from fall until spring, the answer will not be found ready-made. To a predominating extent, probably, local circumstances will determine the cost of storing wheat on the farm, in country elevators, and in terminals, and the value of the service in terms of farm price.

In summary, the expenses attending the storage and carrying of wheat represent a range, varying from city to city for terminal storage and from region to region for country storage, and varying also from year to year. Leased storage space in terminal elevators costs more in the operation than using storage space owned by the merchant himself storing grain. In general, the estimates of the effective charges involved in terminal storage are apt to be too high, and this despite the recognized fact that a terminal elevator cannot make money in an average year by leasing storage space. The expenses of country storage, on the other hand, tend to be underestimated. Finally, the expense in storing wheat may be modified by transportation charges. Under favorable circumstances, a program of storing wheat over the winter might be carried through at a relatively low weighted average price; under unfavorable circumstances, the cost might be two or three times as much. In fact, in each crop year, the prospective expense of carrying any large amount of wheat over the winter would represent a different as well as a difficult problem.

The Carrying Charges and the Recurring Seasonal Price Advance

Other things being equal, the price of a commodity produced seasonally and consumed continuously would be expected, during the interval between one producing season and the next, to rise by enough to cover the carrying charges. The price of new-crop wheat (other things being equal

and especially in the absence of a secular trend in the wheat price or of a shift in the wheat price level) would be expected to rise month by month until the end of the crop year. Even when other things are equal and the wheat price level is unchanging, the recurring seasonal price advance is somewhat conditioned upon two circumstances: the behavior of prices in transition from the old-crop year to the new-crop year, and the sagging of wheat price commonly observed when the new-crop wheat flows actively to market.

The initial phases of the question of the recurring seasonal price advance lie in the last weeks of the old-crop year and in the first weeks of the new-crop year. With unchanging wheat price level and other things (especially quality) equal, the oncoming price of new-crop wheat tends to stand lower than the price of old-crop wheat; this is implicit in the theory of the carrying charge. New-crop wheat without established milling values will be priced relatively lower than old-crop wheat with established milling values, until the mills have determined the quality of the new crop. How to climb down, so to speak, from the relatively high level at the close of one crop year to the relatively low level at the beginning of the next crop year, constitutes an annual problem in the grain trade. This annual problem is illustrated in the difficulties of transition from the May to the July future, and from the July to the September future, even in years with unchanging wheat price level. Since 1900 (excluding the years 1915–20), during May the July and September futures were at a discount under the May future in eighteen years and stood at a premium in five years. Clearly the usual relationship in May is to have the May contract price stand above the price of the July and September futures. This, however, is conditioned on the size of the carryover. If the visible supply and prospective carryover of old-crop wheat appears relatively small, then during May the May future will stand at a premium over the July future; if, on the other hand, the visible supply and prospective carryover of old-crop wheat appear large, the July future will tend to a premium over the May future.

What may be termed the marketing sag (or dip) in the post-harvest price of new-crop wheat is naturally modified by the prospective size of the crop. With a short new crop, there may be no price dip, with probability of rise in the wheat price level; with a moderate crop, involving no change in the wheat price level, the sag will be of varying depth and length; with a large crop, even though no change in the wheat price level is eventually evolved, the sag tends to be deep and more prolonged. This marketing trough usually appears in July, but may be anticipated in June; it may be deferred until August or longer; it may last from one to three or even four months. In this post-harvest dip participate both old-crop and new-crop factors; indeed, there is ground for the belief that in some years the carryover of old wheat has more influence on the marketing sag of the price of new wheat than has the volume of marketing of new wheat.[1]

Wheat growers have long been convinced that this price dip in the early months of the new wheat year is exaggerated by speculation. At this time there is usually a heavy volume of selling hedges. Millers and merchants buy in the country, where few notice the cash transactions; they hedge in the terminals where everyone sees them selling hedges. Wheat growers believe that in addition to a seasonal increase in selling hedges, insuring the early purchases of cash wheat by dealers and millers, the sag in prices is intensified by speculative short selling. The presumptive objective of such short selling would be to increase speculative profits, on the hypothesis that the peak of the price to be attained around May in the recurring seasonal price advance would be the same, even though this price advance began from an artificially low point following the harvest. Since farm sales would be active during the period of post-harvest dip, the net effect of such short selling would be to enrich speculators at the expense of producers. Thus runs the bill of grievance.

As wheat growers view the situation, the gain which accrues from carrying the wheat over the winter is composed of two fractions: one, a more or less artificial ex-

[1] That congestion in terminals tends to depress cash prices, even on a rising market, has been again illustrated during recent months.

aggeration of the post-harvest price decline, and the other, the gain secured in the subsequent recurring seasonal price advance.

From the lowest point of wheat price in the early months of the new-crop year, begins the month-by-month increment in wheat price which, extending to the end of the crop year, constitutes the recurring seasonal price movement. The extent of this price movement obviously depends upon many factors, varying from year to year, outside of the carrying expenses of which it is in theory the direct expression. It is therefore difficult to measure the recurring seasonal price advance independent of other factors which add to it or detract from it. We have recently collected statistical material bearing on the subject in an attempt to compare the extent of the recurring seasonal price advance, strictly construed, with the costs of carrying wheat over the interval.[1] From the data thus assembled emerges the conclusion that when proper account is taken of the variability of extraneous factors, the increase in price of wheat over the winter is usually not enough to cover the expenses of carrying the wheat over the interval. Only in an occasional and exceptional year, and particularly in the event of rise in the wheat price level, does wheat in the spring and early summer sell for enough more than the same wheat sold for in the previous autumn to cover the expenses of storage. As against exceptional years of gain with rising price level must be balanced the years of heavy loss with declining price level. This conclusion, which we reach in spite of what we acknowledge to be none too exact a measurement of the amount of carrying charges, is in harmony with the appraisal of the subject by the Federal Trade Commission.

Since now it seems clear that with an unchanging wheat price level the recurring seasonal price advance is usually not enough to cover the costs of storage in terminals, a storage account becomes speculative. In crop years when the price level rises, the May price would be above the price of the preceding August, for example, by more than the cost of carrying wheat; but in crop years with decline in the wheat price level, the price in May would be relatively low, or even absolutely below the August price. But balancing the gains in years of increasing wheat price level against the losses in years of decreasing wheat price level, it follows that the cost of carrying wheat over the winter is not as a rule covered by the increase in wheat price from August–November to May, as revealed in the reported terminal prices.

Whether this holds for farm price of wheat also has not been demonstrated; but the natural presumption lies in the same direction. In short, in years of unvarying wheat price level and other things equal, it is not possible routinely to purchase cash wheat after the harvest and carry it over the winter at a net profit. Furthermore, it is not possible under the same circumstances routinely to purchase cash wheat after the harvest, hedge the transaction in the May future, and in the following May sell the wheat and buy in the hedge at a net profit. As a straight transaction it is not routinely possible to buy wheat after the harvest, hedged or not hedged, and sell the identical wheat in May at a net profit.

If one observes the operations of grain trading in terminal markets, and in connection with these observations peruses the Federal Trade Commission's reports on the grain trade and the recent book of B. F. Goldstein entitled *Marketing: A Farmer's Problem,* three inferences will emerge. First, it is not routinely possible in cities to conduct elevators as a pure warehousing proposition, at the current rates of storage, insurance, and interest applied to wheat and secure operative income sufficient to cover insurance and interest on the investment in the elevator. Second, it is not routinely possible in cities for grain merchants not owning or operating elevators to engage in the handling of wheat on the basis of leasing elevator space on toll at the established rates and secure enough operative income to cover prudent interest on the investment and a modest reward to the entrepreneur. Third, it is not routinely possible to find the recurring seasonal price advance of wheat sufficient to cover the cost of carrying the wheat over the interval. But year after year much wheat is car-

[1] "Variations in Wheat Prices," WHEAT STUDIES, June 1929, V, 241–300.

ried over, and it is not done at a routine loss. The explanation of the riddle lies in the merchandising practices of the grain trade.

Sources of Profit to Elevator Operators

These conclusions are enforced by consideration of the actual operations whereby elevator companies obtain their profits. Grain dealers in terminal cities carry on four interrelated departments of their business. Though interrelated, these departments are susceptible of decentralization, both in management and in accounting. The accounting of a grain house is made difficult by the fact that the operations of the fiscal year are not sharply terminated with the crop year, since both cash wheat and wheat futures are carried over to varying extents. Also, it is difficult to segregate the items of separate and joint expense; indeed the accounting in this respect is to some extent always arbitrary and the practices of accounting are not uniform throughout the trade. What may be termed the four departments of a terminal grain business are the following:

1. The operation of terminal elevators (with or without country line elevators) owned or leased, both public and private.
2. The mixing of country-run wheats to conform with federal grades.
3. The merchandising of the several and special wheats on the basis of commodity values, especially premium wheats.
4. The management of the hedging account.

Often, in some cities usually, terminal elevators are leased (for example, from railways), not owned, by grain houses; the country line elevators are usually owned. If the terminal elevators are owned, there is an appropriate investment account, with provision for insurance, depreciation, and upkeep; if the elevators are leased, there is a rental account, with provision for insurance and upkeep. Whether owned or leased, there is an operating account. In the private elevator only the grain of the operator is stored; in the public elevator operated by a grain house are stored both the grain of the operator and the grain of clients, on toll at established rates. All legislative attempts to divorce the warehousing of grain from the handling of grain have failed.[1] Except at the seaboard, there is practically no such thing as a terminal grain elevator conducted strictly as a warehousing proposition, rendering services on toll at established rates. Any idea that the warehousing of wheat is comparable with warehousing of household furnishings, or of distributive stocks of finished commodities, is entirely erroneous.

Under the existing system of trading in futures on grain exchanges and including the hedging of wheat purchased for cash, the control of a terminal elevator is the indispensable basis of the operations of the grain house. On the basis of leased public space, no modern wholesale terminal grain business can be operated. The control of the terminal elevator provides the opportunities for the operations of the three other departments of the business. It is necessary in the appraisal to separate the elevator man operating for others on toll from the same person operating for himself as merchant. The elevator man will not put in store in his public space the wheat of another merchant unless paid his formal storage charges at published rates.[2] But he will put his own wheat in store when he knows that he will not receive out of the transaction, correctly accounted, the storage charges which he would collect from a storage customer. That is, in effect, he cuts the storage rate to himself on his own wheat. On his books he may charge the full storage rate, or he might assign a flat low rate, or he might compute the return for storage as the final result of the accounting. He may, according to his accounting, lose money as an elevator man and make money as a merchant; he may make money as an elevator man and lose money, or make less, as a merchant. When the business is analyzed from the standpoint of management involved, it is clear that the money is made in management of merchandising rather than in management of storage. It is from this point of view that one must accept the customary statement that only in highly exceptional crop years do grain houses receive on grains stored in

[1] Cf. B. F. Goldstein, *Marketing: A Farmer's Problem* (New York, Macmillan, 1928), pp. 269–76.

[2] Cut rates, published and applicable to all grain in store, occur but are not common.

the elevators they control anything corresponding to the current storage charges.

If there were no trading in futures and no hedging of cash transactions, it would be possible to picture the operations of a grain house engaged in mixing and merchandising wheat without being simultaneously engaged in running a public grain elevator; but so long as there is trading in grain futures and so long as the insurance features of hedging are accepted as desirable in the interest of growers, the business of the elevator man and of the grain merchant seem necessarily conjoined.[1]

With his operations protected by control of storage space, the grain merchant puts in his stock of goods—namely, wheat purchased in the country—and hedges his purchases in an appropriate month and market, within limits irrespective of whether or not the difference between the price paid for the wheat and the price of the wheat future in which the hedge is sold covers the regulation storage charges, interest, and insurance. The merchant is aiming at volume of operation and unless there are contra-indications wheat is almost routinely bought and placed in store when the margin between the cash and the future is wide enough only to cover interest and insurance. Grain merchants not only buy wheat, hedge it, and then merchandise it, but they also do the opposite—under certain circumstances they buy wheat futures, and take delivery when the price looks right.

With large and workable volumes of various wheats in hand, the operations of mixing and merchandising proceed, and here the particular qualities of management of the grain house are revealed. These two departments are really conjoined, though the one is largely an internal operation and the other largely an outside operation. The customers of the grain house are millers, manufacturers of various cereal preparations, exporters, and other grain merchants.

As the crop year progresses, the hedges may be transferred from one market to another and from one month to another in accordance with developments of prices in futures, and are closed out whenever wheat is sold. The objective of these operations is to widen the margin initially secured between cash and futures. The hedge is not merely an initial insurance, it is a progressive insurance, usually perfected by the handling of the hedging account; and therefore, somewhat paradoxically, one refers to profit or loss in the hedging account.[2]

When the season is over, the various debits and credits are assembled in the combined account, and there is usually left a profit. Predominatingly, this profit on money invested and reward of the entrepreneur is not the profit on carrying wheat; it is the profit on merchandising operations, to which the carrying of wheat is merely a necessary incident. The profit is not secured as the direct expression of the recurring seasonal price advance; this would usually not be enough to reward the entrepreneur and pay interest on the capital invested.

The wheat growers' co-operative associations would presumably execute the functions now carried out by wheat merchants in respect to the seasonal carryover, except the hedging account. It does not lie within the theory of co-operative marketing of wheat to have the association hedge receipts from members as the grain trade hedges purchases. Even those who believe that co-operative associations ought to deal in futures for the furtherance of certain objectives, as does the central selling agency of the Canadian wheat pools (to which we shall later advert), do not contemplate a futures account based on the hedging of wheat receipts. To the extent, therefore, that the hedging account contributes to the net profits of wheat merchants, the co-operative associations would thus secure smaller profits from the operations when they replace these merchants in the distribution of wheat. On the other hand, centralized management and the possession of larger volume of wheat would tend to increase the earnings of the associations.

[1] Cf. B. F. Goldstein, *op. cit.*, pp. 261–81.

[2] Not infrequently developments in futures and in premiums for cash wheat are highly favorable to the grain dealer, and sometimes the relations of prices in different months provide opportunity for profit. "We purchased some March wheat and sold May against it at 4¼ cents difference, which is at the rate of 36 cents per bushel per annum, and much better than a carrying charge after paying a good rate of interest, full storage and insurance." (From column of market comment of Uhlmann Grain Company, *Chicago Journal of Commerce*, March 9, 1929, p. 12.)

Conclusions

We may conclude that the prospect that co-operatives or a stabilization corporation have of making money directly as result of carrying wheat from the harvest to the following spring is not promising. This holds for co-operative associations in the same manner as for the terminal grain dealers, when the returns from mixing and merchandising of wheat are separated from returns on warehousing. There may be other reasons for carrying wheat, by grain dealers or by co-operatives; but direct net profits on carrying wheat as revealed in the relation of the recurring seasonal price advance to the expense of carrying wheat is not an adequate reason for carrying wheat. There may be large gains in particular years; but there will be losses in other years. There may, indeed, be reasons for expecting that wheat co-operative associations, or a wheat stabilization corporation, will make as much or more money from mixing and merchandising of wheat than the combined terminal grain dealers make; but the negative experiences of terminal grain dealers in respect to profit on direct carrying of wheat will hold for producer-controlled organizations.

What has been said above applies solely to intraseasonal operations, the carrying of wheat over the winter to be disposed of during the terminal months of the same crop year. Carrying wheat from one crop year into another crop year is a topic involving entirely different factors. To the subject of interseasonal carryover we shall return later in dealing with crop-year carryover, export dumping, and interseasonal stabilization of price.

V. OPERATIVE PROCEDURES

Price-Influencing Procedures

On the basis of available experiences, there are three different ways in which the value-influencing procedures of co-operative associations or a stabilization corporation might be applied to wheat. The first method would be application of the procedure to all grades of wheat, under appropriate differentials, changing from year to year or even within a year. This was the scheme adopted during the war. The second method would be to limit the procedure to wheats of the basic contract grades and upward. The third method would be to remove from the market all substandard wheat, disposing of it abroad or at home for purposes other than flour milling for domestic consumption, and thus promoting the rise of prices of standard and premium milling wheats in the absence of competition from lower-grade wheats. It is our purpose in the present section to indicate the problems which a Farm Board would naturally face if it determined to operate upon any one of these three bases.

In the program it would be necessary to take account of the relations of flour grades as well as of wheat grades. Flour millers purchase wheats primarily from the standpoint of flour grades and only secondarily from the standpoint of wheat grades. Except in custom mills and in isolated regions, little remains of flour ground from country-run or elevator-run wheat; flours having any considerable range of distribution are made from blends of wheats. Some superfine brands of flour are made from premium wheats exclusively. But for the most part, standard patent flour for the family trade is made by grinding a blend of premium wheats and wheats deliverable on contracts, in different proportions from region to region and from year to year; and often to some extent including also discount wheats or even low-grade wheats not deliverable on contract. Standard patent flours for the bakery trade are usually made from a blend of much the same categories, though bakery flours contain as a rule a smaller proportion of premium wheat than flours for the family trade. To some extent, straight flours are made from wheats deliverable on contracts and discount wheats, without admixture of premium wheats, but such flours are distinctly inferior to the representative American flour. Export flours ground from domestic wheats are usually manufactured from wheat blends distinctly inferior to blends used for flour for the home market. So-called self-rising flours are usually long

patents, or straights, made from wheat deliverable on contracts and discount wheats; some lower-grade self-rising flours are blends of straights with clears secured from the manufacture of patent flour containing premium wheats.

For the household trade, the mills manufacture flours to meet and maintain established standards sold under brand and trade-mark. But for the bakery trade flours are being manufactured more and more on specification. Usually bakeries specify exactly what the flour must do and then leave it to the miller to blend the available wheats in order to secure the desired result, leaving the clear flour in the hands of the mill. Occasional bakeries prefer to contract for a specified rate of extraction, with instructions to the mill how to cut the straight flour into patent and clear flour, both of which are taken by the buyer. The recurring problem of the flour mills, a problem at once comprehensive and intricate, is to manufacture relatively unchanging flours from continually and often widely varying raw materials.

The weighted price of the crop milled in this country is thus the composite of a considerable number of factors. Whenever the wheat crop of a year, as it stands, is to be managed from the standpoint of maximum returns to growers, this may tend to result in favoring some wheats and discriminating against others, to the gain of some growers and to the prejudice of others. The co-operative associations would need to deal more or less heavily with low-grade as well as with high-grade wheats, of both esteemed and undesirable varieties. It would be necessary to fit these procedures into the milling situation at home and into the demand situation abroad. Thus, the domestic operations would be modified by the crops of other surplus-exporting countries, and by the varying demands of European and other countries.

In consequence, the approach to influencing farm prices of wheat through control of terminal prices of grades under the federal standards must take account of the present conventional operative classification of wheats into premium wheats, wheats deliverable on contract with or without discount, and wheats which are not deliverable at all.

We shall repeatedly employ the terms "representative wheat" and "substandard wheat," and "representative flour" and "substandard flour." Under representative wheat is to be understood wheats adaptable, by type, variety, and quality, to the manufacture of standard flours meeting the specifications of consumers in the United States and marketed more or less nationally under brands. Thus construed, the representative wheats include only those of contract grade and higher, but by no means all of such wheats of contract grade. In most years the representative American wheats (outside of durums and Pacific wheats) carry some premium for quality, i.e., premium over the contract grades. Substandard wheats are wheats which do not lend themselves directly to the manufacture of such standard flours. Thus construed, considerable wheat of contract grade is substandard; some substandard wheat is, however, blended with representative wheat in the making of flour of representative grade. In short, we have spring wheats from which a representative hard spring-wheat flour cannot be made, hard winter wheats from which a representative hard winter-wheat flour cannot be made, and red winter wheats and white winter wheats from which a representative soft flour cannot be made. The divergence between representative and substandard wheats and representative and substandard flours is due in part to inherent defects in the wheats, or in the regions in which they are grown, but in large part to high flour standards that have become established in the United States in households and in the manufacture of bread, crackers, and sweet goods. The differences between representative and substandard wheats and representative and substandard flours vary somewhat from year to year; also, the fact contained in the distinction, with the corresponding implications, must not be used in an exaggerated form in discussions. Nevertheless, the fact is of outstanding importance because Canada, Argentina, and Australia always export representative wheats and corresponding flours, whereas the United States for the most part, after the domestic wants have been supplied, is able to offer only substandard wheats and flours.

In what follows we shall describe the alternative procedures with sharp distinctions. Done for the sake of clarity, the contrast will thus be overdrawn. In fact, the three procedures may readily merge into each other and overlap, though the objectives remain distinct when discriminatingly appraised. There is from crop year to crop year a varying relation of good to poor wheat, both at home and abroad, and the widely varying proportions modify more or less the range of wheat prices and the premiums and discounts. Somewhat paradoxically at first sight, but reasonably enough on technical considerations, the world market demands both good and poor wheat, and this circumstance modifies prices in all exporting countries. Directly considered, the three procedures might be comparatively appraised on the basis of precedents. But no such order would necessarily hold in practice, since the advantage of one procedure over another would be modified by varying circumstances in the wheat markets at home and abroad. The wheat-importing countries endeavor to secure certain qualities in their imported supplies and at the same time to pay the lowest possible weighted price for import wheat. American wheat growers endeavor to make domestic millers pay as much as possible for the flour qualities involved in consumers' preferences, and at the same time sell abroad for as much as possible the wheats finding no utilization at home. Thus the merchandising tactics under the Farm Board must be continuously changed to meet varying conditions at home and abroad; and in any one crop year the same marketing treatment, so to speak, might not be found applicable to the different wheat regions. Success will depend upon mobility of procedures as well as upon correct appraisal of current conditions.

Trading in Futures

On the assumption[1] that the Farm Board would not wish to set up a monopoly of wheat, with the corresponding price-fixing entailed, but would prefer to have the price openly registered on the market, it follows that the practices and facilities of the grain exchanges would be made use of under the new system. Making use of the grain exchanges does not mean tolerating their continued existence; it implies a positive policy of adding trading in futures to the armamentarium of the co-operative associations and the stabilization corporation, just as has been done by the wheat pools of the Canadian Prairie Provinces. There are good reasons for believing that trading in futures, discriminatingly employed, may render distinct service to wheat growers.

It has not been supposed to be necessary (or indeed proper) for a wheat growers' co-operative to hedge receipts of wheat delivered by members. Since the co-operative would possess a large volume of wheat, it is secure when the contracts of a trading month are closed out. Since a co-operative does not buy member-wheat in the ordinary sense, but only sells, the position is somewhat different from that of a stabilization corporation, which would need both to buy outright and sell outright wheat both of members and non-members. The Canadian pools (and, so far as we know, this holds for all the small American pools) do not hedge receipts; consequently, we take it that if wheat growers' associations were to be created under the new Farm Board they would not hedge receipts, at least from wheat members.

But even if wheat growers' co-operative associations did not hedge wheat receipts, they still could not avoid trading in futures, if the futures market persisted. When a pool sells wheat to millers and merchants who practice hedging, it is often compelled to accept their futures contracts in closing the transaction. These futures must then be closed out on the exchange. Thus, as seller of wheat, so long as the present system of grain trading is in operation, wheat growers' co-operative associations must engage in trading in futures, even though as buyers of wheat they do not so engage.

More important still in this connection is the fact that dealing in futures will present an alternative method of merchandising. Desirous of securing wheat from non-members, the co-operative association or the stabilization corporation could purchase cash wheat for immediate delivery or purchase futures for delivery in a sub-

[1] See above, pp. 373 ff.

sequent month. Such purchase of futures would not be speculation, because it would be done with intent to accept delivery. Purchase of premium wheats would need to be made on the cash market; but purchase of contract and discount wheats could be secured in either way. Indeed, filtering through the markets and being delivered on futures contracts in December, March, and May would represent perhaps the best way of purchasing the wheats for which domestic use is not available. Presumably purchasing futures in the summer and fall would have as much influence on the post-harvest price as purchasing cash wheat; probably purchasing futures after the harvest and accepting delivery in May would have a better influence on the recurrent seasonal price advance than purchasing the deliverable wheats for cash after the harvest and carrying them over the winter.

Similarly, the wheat growers' co-operative associations, or the stabilization corporation, could sell wheat either for cash or with futures. The seller of wheat can sell spot or to arrive for immediate delivery or on the cash market for deferred delivery; or wheat futures may be sold and delivery enforced in the contract month. For a wheat pool to sell futures and make delivery is not a speculation, because the wheat is in the possession of the seller and the contract is made with intent to complete delivery. Wheat sold on futures and delivered represents a sale to a general purchaser rather than to a specified buyer; it is a common practice of the central selling agency of the Canadian wheat pools.

A wheat growers' co-operative association has thus two ways of selling: spot sales and wheat futures. In possession of the wheat, it is quite immaterial to a pool whether a buyer buys cash grain today (and hedges it in a distant future) or whether the pool sells a corresponding volume of wheat futures in the same distant month. In the broad sense, if the position is watched carefully, it ought to be quite immaterial to the pool whether it disposed of its wheat by the cash route or the futures route. This is the point of view of the Canadian pools, as made clear in the testimony of A. J. MacPhail, in the recent Congressional hearings.[1] Indeed, it seems clear that by a combination of the two methods—selling for cash and selling through futures—the field of choice in selling wheat is widened and the opportunities for merchandising enhanced. Since the wheat pool possesses the wheat, selling wheat by contract, which is what futures selling is, is merely a form of selling for deferred delivery. But it is the operations of speculators that make this possible for a wheat pool.

Further, it is possible to extend more widely the suggestion for participation in trading in wheat futures. Looking backward, it is easy to point out crop years in which it would have been advantageous to wheat growers' co-operative associations to sell wheat futures against the unharvested crops or to buy wheat futures before the crop is harvested, to make or accept delivery of the physical wheat after the harvest. For illustration, it would have been profitable for a hard winter-wheat co-operative association to have sold wheat futures in the spring of 1928 and made delivery on the contracts in September. Conversely, it would have been profitable, in Kansas City in the early summer of 1929, to have purchased wheat and accepted delivery on the contracts in September. It will be rejoined that "hindsight is easier than foresight"; but these are relative opinions. A well-equipped Farm Board would possess foresight as well as hindsight. Such transactions by a wheat growers' co-operative association would not be speculation in the sense of the grain exchanges, since delivery or acceptance of delivery would be physically possible and desired. With due regard for acreage under control of the co-operative association, buying or selling wheat on futures before the crop is harvested is not essentially different from buying or selling wheat on futures after the crop is harvested.[2]

Lastly, occasions might arise when it

[1] Senate Committee on Agriculture, *Farm Relief Legislation Hearings*, April 4, 1929, pp. 555–88; also House Committee on Agriculture, *Agricultural Relief Hearings*, April 5, 1929, Serial A—Part 9, pp. 836–56.

[2] We follow the loose conventional usage of the word "speculation." More strictly construed, investment shades into speculation both with securities and with grains. Purchase of grain futures with intent to take delivery and sale with intent to make delivery are not regarded as speculation on grain exchanges, but might be so regarded in other circles.

would seem commercially advisable for co-operative associations to enter the futures market in futherance of a price policy. Usually such an operation would be in defense of a price; but occasions might arise when a growers' co-operative association might find it advisable to sell futures to restrain a temporarily undesirable rising price of wheat. The Canadian wheat pools have on occasions dealt in wheat futures in furtherance of their price policy. This represented entrance into speculation, usually for the purpose of supporting the price of the wheat or to facilitate transition from one crop year to another. But speculation by a pool is always different from speculation by an ordinary trader since the pool is always physically prepared to accept or make delivery.

It may be objected that one of the implied purposes of legislation for farm relief is to get rid of speculation in grain; instead the above proposals contemplate continuing it. In spite of this, and regardless of the present or ultimate attitude of growers toward futures trading, we hold it in the interest of growers for the time being to make use of speculation. Indeed, we regard it as an outstanding advantage of co-operative marketing of wheat, that wheat futures may be purchased with intent to accept delivery and wheat futures sold with intent to make delivery. In short, we regard these transactions as valuable merchandising tactics. It is difficult for us to picture national and international marketing operations of a wheat stabilization corporation without the fullest use of the facilities of grain exchange trading, on occasions at least, so long as trading in wheat futures continues actively. It might frankly find it desirable to regard speculation in wheat, under the existing conditions in the world wheat market, as a necessary part of its operations, particularly since, in possession of large funds, in control of a large volume of supplies, and in position to advise wheat growers as to the rate of marketing of their crops, the hazards of speculation would be reduced to the minimum.

The Procedure Applied to All Wheats

Probably what would generally be regarded as the most natural method of influencing the price of wheat would be to include all varieties, grades, and qualities in the operations. From year to year, the crops vary in the several regions, with changes in the proportions of the different types. From year to year the proportions by grades and qualities vary within each type. As a rule, there is a shortage of one variety of hard wheat, sometimes of both; often there is a shortage of soft red winter wheat and sometimes a shortage of hard white Pacific wheat. Usually there is a relative shortage of dark northern spring and of dark hard winter wheats, and a relative excess of northern spring and of yellow hard winter wheats. As a rule, there is a relative shortage of wheats of federal grades No. 2 and better, and a relative excess of lower grades of the representative varieties, of undesirable varieties, and of mixed wheats. There is usually a shortage of high-protein wheats. During each crop year certain varieties, grades, and classes stand at a premium, others at a discount.

At first the effect of the entrance of the stabilization corporation into the wheat market will be to elevate prices, with the public drawn into the movement of buying wheat. This may lead to an overbought position with sharp recessions, followed again by rise of price. After a time, the wheat merchants and speculators will learn to make allowances for the dealings of the corporation, and the situation will be changed from the present mainly by the added participation of one more factor in the market, albeit an outstanding factor.

The co-operatives, or the stabilization corporation, without stating prices, might announce for the several terminal markets or at country points, the differentials at which would be taken all wheats offered, with premiums and discounts established between the several grades and varieties in accordance with quantity, quality, and milling requirements, with adjustments for freight rates in the several regions. During the war the fixed price of wheat was for No. 1 Northern Spring at Chicago, with differentials for other grades and markets and adjustments for regional distances.[1]

The particular advantage of such a plan lies in the maintenance of established prac-

[1] Cf. F. M. Surface, *The Grain Trade during the World War* (New York, Macmillan, 1928), pp. 72–75.

tices on the cash markets and on the grain exchanges of the country. The outstanding difficulty would lie in the time of price appraisal. The successive months of harvest of the several domestic wheats of the different regions, from May to September, make the setting up of differentials for the crop year both difficult and hazardous. To set them narrow would be to offer little advantage to growers; to set them wide would be to run grave risk of financial losses. To change the differentials from month to month would tend to restrain trade. Something would depend upon which was the primary and which the secondary price objective—merchandising of wheats or elevation of prices.. If elevation of price were the primary objective, different tactics might be indicated. It might be possible, or necessary, to adjust the differentials from time to time in conformity with movement of world prices.

As against the suggestion for announced differentials for the crop year (in view of the difficulty of setting them up when the winter-wheat crop comes in and out of regard for possibly hazardous contingencies), the policy might be adopted of basing the differential operations on the Canadian price as a base-line, and utilizing in each year and in every possible way for improvement of domestic price, the various wheat crop factors as they develop from the close of one crop year to the opening of the next. This is necessarily the policy of the Canadian pool, which safeguards its operations by making the initial payment to growers so far below the prospective price level as to provide a safe working margin in the merchandising of all grades. The Canadian problem is relatively simple, because all the crop of note is spring wheat and comes in at one time, whereas the American wheat crop consists of five or more types harvested in four regions at different times.

The four regional wheat growers' associations would need to work in accordance with an agreed mutual policy, seeking coordination rather than competition. This would constitute a difficult undertaking, since growers of premium wheats in any one region would resent any appearance of interference on behalf of the wheat of another region. A wheat stabilization corporation would need to establish the same harmonious policy. The general plan would be to disturb commodity trade as little as possible. With four regional wheat growers' co-operative associations, this would lead to mergers of line elevator companies, as in Canada. The elevators and mills should buy cash grain during the harvesting period; the stabilization corporation should buy futures. This would seem the best way to influence price, to buy futures and later take delivery, helping the price during farm marketing and securing possession of grain later, without upsetting the sample-trading methods of the trade.

It would need to be decided which wheats, if any, would need to be "dumped." It would be necessary to establish a policy of disposal of low-grade wheats on the feed market. The amounts and proportions in which the several wheats would be carried into the carryover would need to be determined. Each crop year would represent a new set-up, a different series of problems with the necessity of varying and sometimes extensive adjustments—in short, each crop year would be a new period of experiment, becoming somewhat easier with accumulating experience, but still with the possibility of uncovering a novel situation for which no precedents would be available.

Whatever the differentials adopted, the policy of administration would be to "feed out" the wheats to the milling industry in such a manner as to secure the maximum influence on the price of wheat to be derived from competition between mills. Such competition now makes effective the premium prices for wheats that are more or less current during each crop year. In attempting to intensify the competition between mills by holding back wheat desired by mills, caution would need to be observed not to exaggerate beyond milling values the spreads between premium wheats and discount wheats.

On the face of it, this procedure, directed to the entire wheat crop, would seem to fit in best with the current practices of merchants, grain exchanges, flour millers, and exporters. Since the wheat growers' cooperative associations would be designed to replace independent grain merchants and exporters for the most part, the point would have less importance for these groups. But it would be expedient to have the measures

of merchandising fit in with established practices of flour millers. Millers in particular would favor the procedure applied to all wheats because it would leave the buying and selling of the various grades and varieties on a competitive basis, and cause no arbitrary shift in the costs of making flour. If the stabilization corporation were to buy futures, instead of cash wheat, after the harvest, this would facilitate country selection and buying by mills.

The effect of the new marketing procedures on the grain exchanges would be problematical. If the co-operative associations did not hedge receipts, this would eliminate futures trading now based on hedging of receipts by elevators and merchants. The millers would continue to hedge. If speculative trading were otherwise undisturbed, the elimination of hedging by wheat merchants might tend to increase the insurance value of hedging by flour millers.

But could speculative trading continue in undiminished volume? Speculative dealing in wheat futures is based on short-term price fluctuations, on intraseasonal price changes, and on the prospects of interseasonal price movements. In proportion as the operations under the new régime reduced short-term fluctuations, intraseasonal price changes, and interseasonal price movements, the speculative interest would decline. Under such circumstances, speculative trading might be so reduced as to make the volume too small to absorb even the reduced volume of hedging. More than at present, speculative trading would be based on foreign rather than domestic conditions. Professional speculators might find prospects of gain more attractive on foreign than on domestic exchanges. This has happened before, when for reasons associated with the domestic crop, domestic price fluctuations have been small and speculative interests have directed their attention to foreign exchanges where price fluctuations were wider. An established policy of reducing price fluctuations would tend to restrict the volume of operations in wheat futures on the domestic exchanges and impel speculators to direct their attentions to foreign grain exchanges, to futures trading in other commodities than wheat, or to the stock exchanges. Price fluctuations are entwined with price differentials. The subject of price differentials is one of extraordinary complexity and setting such differentials would constitute probably the most intricate technical determination of the Board.

The Procedure Applied to Higher-Grade Wheats

The second method of influencing wheat prices would consist in applying the operations only to the contract grades of the representative milling wheats. Disregarding for the moment durum and Pacific wheats, this would limit the price-influencing tactics to, let us say, Nos. 1 and 2 Red Winter, Nos. 1 and 2 Dark Hard and Hard Winter, No. 1 Dark Northern Spring and No. 1 Northern Spring wheat. All other varieties and lower grades would be excluded; the co-operative associations would of course receive such wheats from members, but would not include them in their price policies. The stabilization corporation would not deal in them domestically, and would not include them in the carry-over operations, but would include them in export activities. Growers raising wheats outside of the accepted list included in the operations would thus have to shift for themselves. The objectives of such segregation would be to accord to the representative milling wheats the premium values corresponding to their qualities, to encourage the production of better wheat, and to discourage the production of poor wheat.

Despite the attractive simplicity of the initial statement of the plan, the undertaking to operate only with higher-grade wheat would create practical difficulties new to the trade and to the milling industry. With due consideration for the objectives of such price policy, the grain trade and the milling industry would adapt themselves to the innovations in a manner to favor their commercial interests and not to injure them. Limiting the operations to higher grades would mean confining the operations to wheats which, for the crops of 1920–28, have represented the quantities and proportions of the inspected crop as shown in Table 4 (p. 398). From these figures may be formulated an idea of the scope of operations from year to year.

If effective, this procedure would mean that the range of prices between the top grade and the lowest grade would be widened, and a sharper price cleavage would be introduced between the higher-grade wheats as a group and the lower-grade wheats as a group. For the grain merchant, this might tend to diminish the speculative risk in dealing with wheats whose prices were subject to the operations, and increase the speculative risk in dealing with wheats whose prices were excluded. It would tend to intensify the practice of mixing wheats in order to secure as large a volume as possible of wheat included in the classification employed for higher-grade wheats. This would tend to lower the weighted quality of the higher-grade wheats, since grain merchants would use to the maximum the arts of mixing, in order to load the higher-grade wheats as heavily as possible with lower-grade wheats. Thus, the net result would tend to be a reduction in the average quality of the premium milling wheats and widening of the price margin between the representative wheats and the substandard wheats. Other things being equal, lowering the grade of the representative wheats would tend to favor importation of duty-paid wheat in years when the larger part of the Canadian crop is high grade.

The difficulties that would face the flour millers would be of a serious nature, at least in certain years. The mills buy varying assortments of raw materials, namely different wheats, and manufacture a series of products, namely different flours and millfeeds. For the most part, flours are now blends, and the material price sheet, the operative cost sheet (including administration and manufacturing expenses), and the selling price sheet lie on the desk of every mill executive. Anything disturbing the openly competitive relations among the several varieties, grades, and qualities of wheat, would introduce adventitious factors into the conduct of flour milling. This would hold, whatever the relations of the mills to the co-operatives.

Each large mill knows every day (within limits) what it costs to produce the barrel of straight, long patent, short patent, and clear flour and the ton of the several mill feeds from each variety of wheat, each grade of wheat based on protein content. In the large milling centers, the cost of a barrel of straight flour from a premium wheat may be more than a dollar a barrel above the cost of a barrel of comparable straight flour from the grade of wheat deliverable on contract on the futures market. Millfeed prices and expense factors being equal or adjusted, the continuous endeavor of the mills is to meet the requirements of the trade at the lowest cost of raw materials. This means diluting premium wheats with contract wheats and discount wheats, or strengthening contract wheats and discount wheats with premium wheats, as the case may be.

If, now, operations with wheat were to

TABLE 4.—TOTAL INSPECTIONS OF HARD RED SPRING, HARD RED WINTER, AND SOFT RED WINTER WHEATS, AND AMOUNTS AND PERCENTAGES GRADING NOS. 1 AND 2, 1920–28*

Crop year July–June	Hard red spring			Hard red winter			Soft red winter		
	Total inspections	Inspections grading No. 1		Total inspections	Inspections grading Nos. 1 and 2		Total inspections	Inspections grading Nos. 1 and 2	
	(*thousand bushels*)	Amount (*thousand bushels*)	Per cent	(*thousand bushels*)	Amount (*thousand bushels*)	Per cent	(*thousand bushels*)	Amount (*thousand bushels*)	Per cent
1920–21	173,214	57,906	33.4	389,015	250,473	64.4	113,720	73,477	64.6
1921–22	125,229	36,196	28.9	404,494	250,641	62.0	114,427	39,585	34.6
1922–23	165,703	110,743	66.8	295,761	150,095	50.7	94,616	33,467	35.4
1923–24	133,679	52,961	39.6	240,433	138,571	57.6	84,961	50,330	59.2
1924–25	160,939	102,284	63.6	450,385	340,935	75.7	65,543	35,753	54.5
1925–26	176,481	86,832	49.2	194,582	144,470	74.2	55,110	39,248	71.2
1926–27	136,853	51,160	37.4	407,445	347,495	85.3	104,408	75,957	72.8
1927–28	241,294	106,285	44.0	310,295	223,739	72.1	63,635	36,358	57.1

* Data from *Agriculture Yearbook, 1927*, p. 752, and *1928*, p. 683. The data for inspections are for receipts at all inspection points. Percentages computed by Food Research Institute.

be limited to certain federal grades—for example, as specified above—this would tend to increase the margin between the favored wheats and those outside the operation. It would tend to widen the margin between the cost of the barrel of flour from a premium wheat and the barrel of flour from a contract grade wheat or from a discount wheat. With this widening of the margin, the buying practices of the mills would be made more difficult, the manufacturing problem of blending accentuated, and new selling difficulties introduced. In proportion as the prices of flour from the representative wheats rose relatively above the prices of the flours from the substandard wheats, resistance would develop on the part of flour buyers. The large bakers would amplify their efforts to use cheaper flours and the large mills would intensify their efforts to make acceptable flour out of the lower grades of wheat. The stabilization corporation would be pulling one way and the bakeries the other way, with the mills between them.

In particular, the segregation of high-protein wheats would create a disturbance based on the assumption that protein content alone determines price. The premium wheats are purchased by carload lots on individual merit, the premium depending not only on protein content but upon quality of gluten as well, and upon flour yield and other specifications. High-test protein wheats cannot be mixed to obtain an average of protein content in disregard of all other factors. This entails separate binning of quality wheats, which would make difficult the application of price procedures designed solely for premium wheats.

From the standpoint of millers, instead of limiting procedures to premium wheats it would seem preferable to establish clearing houses for premium wheats in the principal markets, through which adjustment of supply to milling demand could be effected in the interest of price improvement. One of the most difficult steps would be fixing the differentials between types, varieties, and grades, especially as the winter wheats come in first and the values of the winter wheats are modified by the characteristics of the spring wheat harvested later.

Under a procedure operating only with premium wheats some restraint of speculation might be provoked, since deliveries are not made in premium wheats, though premium prices are based on contract prices. Purchases of premium wheats could not be made through futures, but only in cash transactions. Sales of premium wheats also could be made only in cash transactions, and not through futures with delivery. In general, a limitation of the operations to part of the wheat crop might tend to limit future trading and open registration of price.

The outcome would be different in different years, depending on the varying proportions of the several wheats. The flour-buying public might not follow the enforced program of higher priced high-grade flour that would be expected to result from exclusive operation with high-grade wheats. It is hardly to be assumed that the high American household standards of flour would yield under pressure of price; but certainly bakers contrast commodity values with prices closely and effectively. The country buying of mills would be disturbed and the selective purchases by which wheat growers now receive their best returns for quality would be disorganized. The mills might find it necessary to curtail their operations with premium wheats and develop the policy of having the flour supply of the year more closely correspond to the average quality of wheats deliverable on futures contracts. In short, the outcome of the policy of improving the prices of high-grade wheats might have the result, for the flour supply of the country, of tending to produce a uniformity in the direction of longer extraction and lower strength, such as was the case during the war, when all wheats were mixed and milled to 74 per cent extraction.

Therefore, the reactions of the flour-buying public, and the corresponding adaptation in practices of the mills, might not work in furtherance of such a policy. All told, a policy of devoting attention only to premium wheats, while in itself logical and attractive, would seem to tend to disorganization of relations between sellers of wheat and the proximate consumers, the mills. What is wanted is directness and simplification in mill buying; complications would hardly enlarge returns to growers.

The Procedure Applied to Lower-Grade Wheats

The third method of applying the price-influencing procedures would be to remove a large part of the unrepresentative and inferior wheats from the market and dispose of them outside of the grain exchanges. This procedure corresponds in spirit with the application to wheat of a type of practice widely used in merchandising perishable products on the basis of rigid grading. When substandard or ungraded fruits and vegetables are withheld from the market, the sale of the graded products is facilitated. The marketing of renovated butters injures the sale of creamery butter. If the packers could less unprofitably dispose of lard and cured fat pork, packing-house operations would be more remuneratively sustained by the sale of ham, shoulders, and bacon. The analogies of course must not be driven too far; the basic consideration is that substandard products tend to compete injuriously with standard products. The removal of the substandard wheats from the market has been several times recommended as an alleviation for wheat growers, and was strongly urged in an agricultural hearing by J. W. Brinton, of the Nebraska Wheat Growers' Association.[1]

The lower-grade wheats might be utilized, along with screenings and feed wheat, as poultry feed, and in the manufacture of mixed feeds; in part, they might be put to industrial uses; in part they would need to go abroad. Under such circumstances, the lower-grade wheats thus segregated by the stabilization corporation would not appear in the visible supply, or in the carryover. Speaking approximately, an 800-million-bushel crop with 100 million bushels of lower-grade wheat removed from the open markets, would roughly correspond domestically to a crop of 700 million bushels of wheat. Removed from the market, the price-effective crop would thus be reduced, though not in corresponding proportion. The price-raising influence of the withdrawal of 100 million bushels of lower-grade would not be as effective as would be the withdrawal of 100 million bushels of higher-grade wheat, but the influence of the operation would still be in the positive direction. To "dump" 100 million bushels of low-grade wheat abroad, especially in the Orient and at a very low price, would lower the world price, but not to the extent that it would raise the domestic price.

One supposed advantage of this procedure lies in the fact that it represents an intensification of what is already current practice. What happens now, for the most part, is that the mills grind the representative wheats, with some blending of lower grades, while the unrepresentative wheats and the lower grades of the desirable varieties pass to other than milling uses and to export. The difference would lie in the mechanism of marketing. At present, the unrepresentative and lower-grade wheats which leave the farms pass to market largely through the grain exchanges, are hedged and unhedged, function in the visible supply, and influence both the cash and contract prices of wheat. These low-grade wheats are not segregated sharply enough so that the distinction is widely known. If low-grade member wheats could be segregated on farms or in country elevators, the price-depressing influence of the merchandising operations directed toward their sale would be greatly reduced.

Such a segregation would reduce the volume of wheat passing through the customary commercial channels and would entail reduced volume to grain merchants. It would restrict somewhat the freedom of buying and scope of blending by flour mills; but if the procedure were carried through with discernment, this effect would be reduced to the minimum. From the standpoint of the mills, the procedure would amount to operating with a short crop of relatively high-grade wheat. The segregation would be different in a year of relatively high grade of quality in the crop and in one of relatively low-grade quality; adaptation would be necessary from season to season. Hedging and trading in futures would be relatively undisturbed.

The wheat growers' co-operative associations would need to secure low-grade wheats from non-members on an initial payment representing a safe margin below their prospective values. Administratively, the problem would be comparable with that

[1] House Committee on Agriculture, *Agricultural Relief Hearings,* April 1, 1929, Serial A—Part 5, pp. 381–420, and Senate Committee on Agriculture, *Farm Relief Legislation Hearings,* April 1–2, 1929, pp. 407–45.

facing the Canadian pools in a year of low-grade crop. Whenever the spring-wheat crop of Canada has a relatively low proportion of wheat of statute grades and a relatively high proportion of wheat of commercial grades (4, 5, 6, and feed wheat, also straight, tough, and rejected) the segregation of the wheat of lower grades constitutes one of the major problems of the pools. In 1928–29 grades Nos. 5 and 6 and the feed grade represented over 160 million bushels, in excess of 35 per cent of the crop as officially inspected. In so far as such wheat may be disposed of as feed or for industrial purposes, or shipped abroad for purposes of feed or for human consumption in countries with low wheat standards, the problem of the pools is alleviated. The advance payments on Nos. 5 and 6 and on feed wheat of course have been much lower than the advance payments on the statute grades. The problem the Canadian pool has had in paying to growers of low-grade wheat the exact values for which they may be merchandised, is similar to the problem that would be faced by American wheat co-operative associations in attempting to improve wheat prices by the removal of unrepresentative and low-grade wheats from the market.

This plan would require, in some years, a larger use of money than would be necessary if only the prices of the high-grade wheats were to be considered, but might require no greater capital than necessary if the same procedures were to be undertaken for all varieties and grades of wheat. Administratively, the procedure would not be easy; but it might be the least disturbing of the three methods under consideration in its effects on the milling industry or the grain exchanges. We fancy that under some circumstances it might be directly quite effective in influence on the price of wheat; but the problem of disposition of losses on the export of the lower-grade wheats would remain to confront the Board.

If the wheat growers' co-operative associations and the stabilization corporation were to remove from the market low-grade wheat representing a substantial proportion of the crop, this would leave the grain trade, the grain exchanges, the speculators, and the millers in a situation comparable to that of a short wheat crop of better than usual quality. The disposition of the low-grade wheat would, however, have some tendency to lower the wheat price level abroad. The low-grade wheat belonging to members would be culled out at the source; the low-grade wheat secured from non-members would be best secured, at least in part, not by cash but by purchase with futures, since delivery on futures would be made with contract or discount wheats. Sale of low-grade wheat, in order to have the least price-depressing tendency, would be made in cash and not in futures. Much would depend upon the volume of sub-standard wheat in the crop; the procedure might be as difficult in one year as it would be easy in another.

Comments on All Procedures

Whichever of the three procedures may be applied, the interpretation of it will be facilitated by an adequate appreciation of the originating organization. The wheat growers' co-operative associations are mergers of producers; the stabilization corporation may be compared with a holding company, functioning as a super-merchant with unusual command of credit. Under centralized management, dealing on a large scale, enjoying the use of a revolving fund, and having unusual command over bank credit, a continuing operation removed from the fear of failure of the ordinary commercial type, a scope and plane of operations is indicated from which alone the feasibility of the three procedures indicated may be judged. Put in another way, these procedures are to be appraised not merely on the basis of content and context but also in the light of the extraordinary organization by which they would be administered. The success of any scheme of price or marketing control presupposes marketing possession of a determining fraction of the supply and implies no substantial change of demand or of production. With wheat a Farm Board could afford to disregard variations in domestic demand; marketing possession of a determining factor of the supply would depend largely upon financial resources.

As between the first two methods the principal difference appears to lie in the fact that the first would best allow differences between certain grades to be estab-

lished by the market. In all three cases there exists substantially the same problem as to how to make effective any price influence decided upon.

In judging of the procedures adapted to the centralized merchandising of the wheat crop, much will depend upon the emphasis laid upon stabilization of prices. If the Board were to seek only such price stabilization as might incidentally emerge out of centralized, sound, and well-managed marketing procedures, then the appraisals given above, based upon the continuation of trading in futures, would stand. But if the Farm Board were to undertake a policy of definitive stabilization and seek specifically to restrain short-time fluctuations, month-to-month fluctuations, the recurring seasonal price change, and year-to-year variations, this could not be done without disturbance of trading in futures. Under such circumstances, the hedges of independent dealers, exporters, and millers would not be carried by the reduced volume of speculation. Also, the co-operative association and the stabilization corporation would find themselves debarred from using the grain exchanges, as we have indicated above, for the buying and selling of wheat through the use of futures. Viewed in this light, we return again to the realization that some contradiction exists between the marketing of wheat as a purely merchandising proposition and the stabilization of the price of wheat. There is more contradiction between merchandising and stabilization of price than between merchandising and enhancement of price.

VI. SPECIAL PROBLEMS OF ADMINISTRATION

Premiums for Quality

Whatever method of price-influencing is employed, it would be necessary in addition to perfect the procedures so that growers would receive payment for their wheat not merely as of grade, but also as of milling qualities. The federal grades are unsatisfactory in several directions and take imperfect account of milling qualities, especially quantity and quality of protein. Mills are interested in the prices of wheat as of the grade, to some extent as source of milling material, but more largely on account of hedging and the possibility of enforced acceptance of deliveries. Their manufacturing operations are conducted on the basis of purchase of wheats by sample and on tests. Quantity of protein, quality of protein, yield of flour, millability, color, ash, and fiber vary from wheat to wheat, even of the same variety and of the same weight, in different years; also in different regions in the same year. More and more as time passes the mills plot the wheat-growing regions for milling qualities. More and more, as country buying has developed, the premiums for quality tend to be reflected back to growers. But it is evident to observers that to a substantial extent growers still receive prices for their wheats only as of grades.[1]

When the buyers for mills purchase wheats, they examine the samples carefully, judge the proportion of vitreous kernels, count the frosted and immature kernels, watch for deleterious inclusions such as smut, garlic, ergot, and peas, determine the weight per bushel, and then on specification for protein content bid so much above or below the contract price, using the current option or a distant one. Only in the case of small mills grinding regional wheats are flours made by grinding elevator-run wheats as of the grade. For practical purposes there is no such thing nowadays as flour that might be termed elevator-run flour; most flours are blends.

When the exporter buys wheat, on the other hand, he usually buys as of the grade, being content to make sure that his purchases will pass inspection at the port. The merchant who sells wheats for export tries to furnish, on the bid accepted, no more costly wheat than will comply with inspection as of grade at the port. Thus the wheat merchant selling wheat to millers and to exporters conducts business on two quite different procedures.

In the hard wheats the most prominent premium is based on protein content. Other things equal, the protein content is of im-

[1] Cf. W. J. Kuhrt, "Accurate Reflection of Protein Premiums to Growers by Farmers' Elevators," *The American Elevator and Grain Trade*, April 15, 1929, p. 592.

portance to bakers because it determines tolerance of flour to modern bakeshop methods, the yield of loaves per barrel, and the texture of the loaf. At the same time, it is clear that the importance of the protein content of wheat has been exaggerated in recent years. There is no parallelism between quantity and quality of protein. Not only have wheats of high protein content been purchased by millers for more than the intrinsic value of the protein in flour, but the graded scale of premiums for increasing amounts of protein has sometimes represented payment of money for differences in protein content that lay within the plus and minus errors of sampling and analysis. The high premiums for protein have prompted a technical re-examination of milling methods; and mills are learning how, with a lower protein content of wheat, to meet the specifications of bakers. Nevertheless, other things equal, the protein content of wheat remains the outstanding characteristic, within the variety and grade, upon which price premiums are based. Protein content, however, plays only a minor role in the dealings in soft red winter and soft white wheats.

The quality of protein is equally important; indeed, it may be more important than the quantity. Two samples of durum wheat of identical protein content may yield respectively a relatively high and a relatively low grade of semolina. Flour made of Black-hull hard winter wheat of 13 per cent protein content is not as good, or as trustworthy, as flour made from Turkey Red wheat of the same content of protein. A 13 per cent protein flour from Kota or Garnet wheat is different from, and inferior to, a 13 per cent protein flour made from Marquis or Reward wheat. Every new variety of wheat introduced has to prove its quality of protein; and many new varieties, with otherwise desirable characteristics, have failed because of low quality of protein present in large amount.

Since, now, the wheat co-operative associations or a stabilization corporation would restrict the scope of country buying by mills and undertake themselves to sell directly to mills, it would be necessary to continue and elaborate the plotting of wheat areas, in each crop year to make early studies of the baking qualities, and to conduct country storage and separate binning of delivered member wheat and of purchased non-member wheat in the country and in terminal elevators, with a view to merchandising wheats on the basis of cash sales by sample and on chemical and baking tests. Success in this undertaking would be largely a matter of administrative efficiency and physical equipment. Though the mills compete with each other for premium wheats, they would presumably co-ordinate their practices with those of the co-operative associations or stabilization corporation, in order to facilitate the selection of wheats for milling. Whether this would entail setting up additional grade standards, on the basis of protein content, need not be here discussed; but it seems inevitable that refinement of the practice of grading at country points would have to occur.

If, on the other hand, the co-operative associations or the stabilization corporation should decline to organize and expand the merchandising of wheat on the basis of milling quality, or should fail to make such efforts effective, the alternative result would be the mixing of wheats to conform to the minimum definitions of the federal grades. There is already too much mixing of wheats just to meet the grades; the practice may be in the interest of exporters but not in the interest of millers. If, discarding the merchandising of wheat by sample and on test as a substitute for country buying of mills, the wheat growers' associations or stabilization corporation were to allow the wheat supply to be physically averaged by grades or between grades, this would tend to discourage improvement in wheats and accelerate the deterioration in wheat quality now widely in evidence. Alike from the standpoints of improvement of wheat, supporting the farm price of wheat, and maintaining the quality of flour to meet American standards, the merchandising of wheat on the basis of quality would seem to constitute an obligation resting on wheat co-operative associations and the stabilization corporation.

The centralized marketing of the major portion of the crop of wheat (the member wheat) would deprive flour mills of some advantages they now enjoy in country buying. The millers have classified and plotted the hard wheat belts, are familiar with the

qualities from county to county, and early in the season make approximate appraisals of the milling qualities of the new crop. In effect, this corresponds to a country-wide extension of the cash grain market, and through country buying the millers are thus enabled to enjoy valuable advantages of selection.

With wheats pooled in elevators of the co-operative associations, this would restrict country buying by mills. If the pool elevators were systematically to mix the receipts of wheat, this would curtail a deterioration from the standpoint of the miller. Selected wheats would be replaced by country-run or elevator-run wheats. In particular, such mixing would render difficult the purchase of wheat on the basis of protein content. Only by separate binning on the part of country elevators would it be possible to retain the scope of selection now enjoyed by mills in country buying.

Separate binning for quality would involve a particularization in the operations of a wheat pool that is not easy to attain. It is the complaint of North American and European millers that under the operations of the central selling agency of the Canadian wheat pools, the selection of wheats for milling quality has not been facilitated.[1] In order to return to individual growers the full prices for their premium values it will be necessary to furnish to millers the full values for premium prices. The problem is made all the more difficult by combine harvesting, since this imposes so heavy a burden upon storage facilities, both on the farm and in the channels of trade, that separate binning for quality is made more burdensome.

The merchandising of premium-grade commodities is a bilateral operation which seems to have been more successful in the hands of co-operative associations dealing with perishables than with those handling staples. The sales market for premium grades must be developed and the full premium prices exacted of users of premium products; the grower must be paid for the premium wheat he delivers. In the case of the California Fruit Growers' Exchange, for example, particular attention is paid to the classification and merchandising of premium grades of fruits, and the grower receives an accounting for his deliveries based on identical classification. The same situation holds for co-operative canneries, and such a rule is indeed imperative in the efficient handling of fruits and vegetables. The price differences between wheats of varying qualities are not as wide as in the case of fruits and vegetables, though they are often surprisingly wide.[2] But accurate classification for miller and for grower is made fairly simple in the case of wheat because wheat is relatively nonperishable; the procedure is largely a matter of a protein analysis and a baking test, and separate binning. Unquestionably, giving satisfaction at the same time to the flour miller and to the wheat grower—price for quality to the grower and quality for price to the miller—will represent one of the important functions of the Farm Board.

Problems of Special Wheats

Our exports of hard spring and soft red winter wheats, and even of hard winter wheat in many years, are largely the wheats culled from the crop by the mills; little representative wheat, and especially no premium wheats, pass into export.[3] In some years, however, hard winter wheat of contract grade, grown in Texas and Oklahoma, is rather freely available for export just after the harvest, when the price of old-crop Canadian hard spring wheat tends to be relatively high. The prices of esteemed millable wheats of these three types stand

[1] On the Winnipeg Grain Exchange is a sample market in name but not in fact; it is a cash market with sales as of the grade for delivery elevator-run at the head of the lakes. But in effect what might be termed an indirect sample market exists. Buyers specify wheat as of a grade from a particular region and the order is filled by diverting cars from the specified district, prior to arrival at terminals at the head of the lakes. For selection as of the grade by districts a small premium is paid; this is more or less routine practice on the part of Canadian mills, Buffalo mills grinding Canadian wheat in bond, and to some extent European mills. Some wheat as of the grade is also sold by selection from different bins at the head of the lakes. Such selections are based largely on weight, dockage, frosted and immature kernels, and estimated flour yield, and to some extent also on protein. Premiums for protein are occasionally paid, especially with a crop of low quality, though the practice does not begin to have the standing it occupies in the United States.

[2] Cf. "Variations in Wheat Prices," Wheat Studies, June 1929, V, 241–300.

[3] The subclasses red spring and yellow hard winter wheat are really unrepresentative varieties.

variably above the world price behind the tariff wall. Of soft white Pacific and durum wheats, on the contrary, we export representative wheats (with some qualifications regarding amber as distinguished from red durum) except in years of exceptional shortage; as a rule, the price level of these wheats is on the export basis; and prices have not been raised above the world price by the tariff. In short, the exports of hard spring, hard winter, and soft red winter wheat are largely incidental, the exports of Pacific and durum wheats are primary. The export trade in hard spring, hard winter, and soft red winter wheats is comparable with that of a by-product or of an occasional surplus; but the export trade in Pacific and durum wheat is a major operation.

Pacific wheat. The wheats of the Pacific states—including Idaho, Utah, California, Oregon, and Washington—will represent a peculiar problem to the Farm Board. Despite regional isolation, Pacific wheat could not be treated as an orphan or a stepchild. These five states as a group produce more wheat than they consume, and a large proportion of the crop must go to export. Most of these wheats are white and soft; some, such as Baart, Bluestem, and Federation, are at best semi-hard; but some hard red wheat is produced in Idaho and Utah. Mills in these states ship in a certain amount of hard wheat from Kansas and Montana in order to strengthen the milling blend; also, there is some shipment of hard spring-wheat flours and hard winter-wheat flours into the Pacific states. California is a net import state; Oregon and Washington are net export states in regard to wheat.

To understand the usual export relations, it must be kept in mind that the export wheats of the Pacific region resemble those of India and Australia. To sell in world markets in competition with Indian and Australian wheats, the price of the Pacific export wheats must approximate world parity, modified by the fact that the seasons are not identical. Even when soft Pacific wheat is exported to the Orient, the transaction tends to have some relation to world price parity because the Australian wheat, which is the chief competitor in the Asiatic market, is at the same time being shipped to Europe. With appropriate reservations, it is therefore correct to say that prices of export grades of Pacific wheat tend to be on the world price basis. Pacific merchants and millers do not regularly hedge their transactions as is done east of the Rocky Mountains.[1] The exports of wheat and flour are often conducted by the same firms in the trade. The grain dealers and millers of the Pacific Coast have open to them, via the Panama Canal, both Pacific and Atlantic markets for wheat and flour. There is some small shipment of wheat and flour overland across the Rocky Mountains, more or less in different years, and some small coastwise shipment of flour to the Atlantic seaboard.

Usually the quality of the soft wheats in the Pacific crop is lower than that of Australian wheats; we export, however, some soft wheat flour equal to the best on the market. Usually the quality of the Pacific semi-hard wheats is inferior to that of Argentina, and we now export no hard wheat flour from the Pacific Coast. In most years, the largest single flour market is in the Orient. The so-called ex-European market for wheat and flour is in several senses peculiar.[2] For a Farm Board to market Pacific wheats on the basis of Asiatic conditions is quite a different thing from marketing wheats raised east of the Rocky Mountains on the basis of European conditions. To elevate the prices of Pacific wheats will tend to mean, therefore, something approaching an export subsidy, in a sense that does not hold for exports from regions east of the Rocky Mountains.

The organization of a Pacific wheat growers' co-operative association would probably be less difficult than in the case of other regions. It would need to include farmers in only three states, Idaho, Washington, and Oregon; the farmers in this section are "co-operatively minded" and the direct dependence on exports would seem to be an assisting factor. It is open to discussion whether Pacific wheat would not best be handled under a stabilization corporation of its own.

[1] In the Pacific Coast states, let it be emphasized, grains are not routinely hedged; the producers of wheat and merchants in wheat are to a large extent speculators in cash wheat, and the losses of some years balance the gains of other years.

[2] Cf. "Ex-European Trade in Wheat and Flour," WHEAT STUDIES, August 1928, IV, 307–56.

Durum wheat. The durum wheats are essentially macaroni wheats, not bread wheats; they are milled to make semolina rather than flour. The largest part of the domestic consumption is in the form of semolina used in the making of alimentary pastes. Small but varying amounts of durum wheat are in some mills ground with hard spring, and even hard winter wheats, to make flour; and considerable red durum is merchandised for feed. The exported durums go largely to Mediterranean countries prominent as users of alimentary pastes, but are to some extent used abroad in making bread flour. There are two classes of durum, amber and red, with several grades of each, amber durum being much the superior variety for alimentary pastes. The durums are often mixed, and the mixtures sometimes include varying amounts of hybrids, such as Kota wheat, and of non-durum bread wheats. On account of climatic conditions in the Dakotas, the durum wheats are apt to display wide variations in quality; there is usually some premium amber durum wheat, but the discount durum wheats commonly include the larger proportion of the crop. Just now, the acreage of durum wheat is declining in favor of Marquis wheat.

Durum wheat will present a peculiar problem. The crop of durum wheat runs from 48 to 93 million bushels. Domestic consumption (food, feed, and seed) is uncertain in amount, but may usually run between 30 and 45 million bushels. Obviously, durum wheat is raised primarily for export. Raising durum wheat for export is quite comparable with raising malting barley for export. There is a futures market for durum wheat on the Duluth Board of Trade, and practically all the exports are sent through Duluth. Since nearly or more than half of the crop must usually go to export, the price of durum is practically always on the export basis. Except in a year of unusually low quality, we export representative durum wheats; but the higher grades of amber durum are less often on an export basis than the lower grades, or than all grades of red durum.

In the same sense as this applies to Pacific wheat, or to a greater extent, to improve the price of durum wheat would resemble an export subsidy, in a sense that does not hold for exports of other wheats east of the Rocky Mountains. Whatever merit may reside in the view that the exportable surplus of hard spring, hard winter, and red winter wheats is the expression of climate, this cannot hold for Pacific and durum wheats. These are in a definite sense export wheats; they are raised for export more than for domestic consumption. Thus the question of surplus control comes under a separate category, with a different meaning for the producers. In one sense, there is no surplus problem in raising a product for export.

Despite the fact that both the domestic and export relations of durum wheat are quite different from those of hard spring wheat of bread type, it would seem impracticable to have a separate management for durum wheat, because in the broad sense these wheats are raised side by side, despite the fact that in some parts of the Dakotas the one type of wheat predominates heavily over the other. Possibly a commodity committee devoted to durum wheat might advantageously function between the co-operative association and the stabilization corporation common to both types of wheat.

Control of the Carryover

In the discussion of various phases of the problems confronting the Farm Board, comments have been made on the handling of the carryover. At the risk of some repetition, the subject is deserving of appraisal under its own heading, on account of the importance it has assumed in public discussions. The current view seems to be that the carryover can be used as a sort of shock-absorber to moderate the effect of variations in supply on price. Since the wheat growers' co-operative associations and the wheat stabilization corporation would have possession of a large portion of the crop, enlargement or contraction of the carryover seems commonly to be regarded as a rather simple technical achievement.

Expansion or contraction of the carryover of wheat might seem indicated to the Farm Board in different years in consequence of varying circumstances in the current and in the oncoming crop year at home and abroad. Part of the carryover of wheat

represents administrative stocks—on the farm, in country elevators, in terminals, in the hands of country and city mills, and in flour stocks variously located—which are larger or smaller from season to season, depending on prices, availability of quality wheats, and other factors.[1] Beyond this, to enlarge the carryover of wheat represents in effect contracting the supply of the current crop year and enlarging the supply of the forthcoming crop year; to contract the carryover is in effect to enlarge the supply of the current crop year and to contract the supply of the forthcoming crop year. These effects apply both to the domestic and to the international situation, and in one sense the ideal policy would be to adapt the domestic to the world carryover.

The quality of the wheat crop may in itself determine a shift in the carryover. It would be doubtful policy, except under unusual international circumstances, to expand the carryover from a crop year of low quality, that is to carry over a large amount of unrepresentative wheat. On the other hand, an increased carryover from a crop of high quality might be indicated. Such is indeed the natural policy of the mills. If in a crop year the high-grade wheats are so abundant that premiums for quality are low, substantially below the average, the chances are that a similar crop would not be harvested twice in succession; therefore, other things equal, it might pay to increase the carryover of high-grade wheat, since this would tend to increase the premiums during the current crop year and if premium wheats were relatively short in the forthcoming crop year the price on the old wheat ought to do more than cover the cost of carrying. There are, indeed, substantial reasons for believing that the policy on carryover ought to be determined largely by considerations of quality in the domestic crop, rather than by quantitative considerations.

[1] On variability of stocks and carryover of wheat, see WHEAT STUDIES, February 1928, IV, 135–80.

[2] Cf. Mordecai Ezekiel, "A Statistical Examination of the Problem of Handling Annual Surpluses of Nonperishable Farm Products," *Journal of Farm Economics*, April 1929, XI, 196–200, and J. E. Pope, "The Holding Movement in Agriculture," *Economic Essays Contributed in Honor of John Bates Clark*, edited by Jacob H. Hollander (New York, Macmillan, 1927), pp. 244–82. See also discussion above, pp. 381–91.

Whenever the stabilization corporation is weighing the practicability of storing, holding, or carrying over wheat, it will need to formulate several estimates.

1. Will the operations show a direct profit or loss, and how much?
2. What effect will the procedure have on the terminal wheat price during the year of operation?
3. What effect will the change in terminal price have on the farm price during the year of operation?
4. What effect will the operation have on gross farm income?
5. How will the direct gains or losses of the corporation compare with the indirect gains or losses of growers, as reflected from the changed price level?
6. What will be the effects in the subsequent crop year?

There is little evidence to indicate that wheat can prospectively be carried from one crop year to another with net profit.[2] But the Farm Board might decide that being in control of a large volume of wheat, under good management it might occupy a better position (than shown for the wheat trade in statistical analysis) to outguess crop developments in the world, world requirements, and the maneuvers of international wheat merchants. It is of course probable that the Farm Board, like the central selling agency of the Canadian wheat pools, would endeavor to contract the carryover with the oncoming of a large world crop and expand the carryover with the oncoming of a small world crop. In their way, this is exactly what speculators are trying to do; the quotations on the distant futures contrasted with those in the month of active trading indicate, in part, the forecast of speculators on price development.

Large world crops are not apt to occur in succession, not alone for reasons drawn from the theory of probability, but also because a large yield tends to reduce the capacity of the soil to repeat immediately with another large yield. On the basis of this consideration, there would be less chance of a third successive large world crop than of a second, which would have some further effect on carryover policy. The same considerations apply, of course, to the domestic crop; in each case the objective of the policy of carryover would be to meet a

small new crop with a large carryover and a large new crop with a small carryover. But the domestic crop might move in one direction and the world crop in another, with the tariff on wheat of assistance in the one case but not in the other. The Board would, therefore, have four factors in the decision in each year: the quality of the outgoing domestic crop, the prospect of the forthcoming domestic crop, the carryover of world wheat, and the prospect of the forthcoming world crop. Other factors might intervene, but these would always be present. So runs the traditional formulation.

To enlarge or to contract the carryover of cash wheat, thus appraised, corresponds with the annual problem of the Canadian pools, of the European wheat merchants engaged in international trade, and of the groups in control of the Argentine and Australian wheat crops. In order to succeed, the European merchant engaged in the international wheat trade must correctly forecast developments seven times out of twelve. In order to make money for American wheat growers by carrying over wheat, the Farm Board would need to make as good a record. Natural possession of a large volume of wheat is sometimes urged as conferring an advantage in competition with international traders; in the long run this may be true, though in an occasional year it is clearly a disadvantage. The leading spirits in the Canadian pools are apparently of the opinion that concordant policies in the principal wheat-exporting countries must be arrived at if full values for export wheats are to be secured for growers. With the large proportion of their wheat going to export, the Canadian pools must formulate an adaptive carryover policy every year. In the case of the United States, however, it might well be urged that motivated expansion or contraction of the carryover (apart from considerations of quality) might well be regarded as an emergency measure and restricted to exceptional circumstances.[1]

In so far as shifts in price level from one crop year to another were due chiefly to international circumstances, the Farm Board would endeavor to forecast the direction of an impending shift in price level and arrange its stocks, merchandising, and carryover accordingly. Presumably the Board could more readily influence a shift in price level due to domestic circumstances than one resulting from international conditions. Precedents are wanted. For example, if, with a moderate domestic crop, the world price were to decline in consequence of large crops in Canada and Argentina, would it be indicated to enlarge the domestic carryover in order to work against the price decline due to world supply? Would the same course be indicated if a major influence in declining world price proceeded from a large crop in the United States? The varying circumstances in different years would call for expert interpretation of world-wide conditions, even with the accepted policy of variation of carryover, and the pitfalls would be many.[2]

The notion that the net result on wheat prices would be in the opposite direction to the change in carryover is, however, not axiomatic. Indeed, circumstances exist under which the opposite would be true. As J. D. Black pointed out in a Congressional hearing,[3] the net effect on wheat price might be better if a short crop were made shorter by increasing the carryover into the following crop than if a long crop were made less long by increasing the carryover into the next crop. However applied, increasing or contracting the carryover would tend to occasion direct losses, against which must be set the indirect gains due to increased wheat price during the two years connected by the carryover under operation. The direct losses and gains might not be difficult to compute, but the indirect losses and gains would be difficult to estimate. From expanding or contracting the carryover arise necessarily added problems relating to export, in particular export dumping.

Controlling the Flow of Wheat to Export

The flow of American wheat to export would constitute two overlapping projects of the Farm Board—the one a merchandis-

[1] For a consideration of the costs of carrying wheat, see pp. 381–91.

[2] The money value of a carryover may be radically reversed within a short time by change in crop prospects. On the first of June it was regarded as unfortunate that our carryover promised to be high. But with the change in crop prospects it now seems obvious that Americans have made money by having a large carryover of old-crop wheat left on our hands.

[3] House Committee on Agriculture, *Agricultural Relief Hearings*, March 27, 1929, Serial A—Part 1, p. 30.

ing task, the other a supplementary price-influencing procedure. As an item in merchandising policy, the export movement would be continuous though seasonal; as a special price-influencing procedure, modification of the otherwise seasonal merchandising movement would be occasional and in the nature of a trading emergency. In the long run the former would represent the more important function.

A. *As merchandising procedure.* The international trade in wheat is a seasonal movement; except under very unusual circumstances, exporting countries do well to conform to the seasonal scheme imposed by the harvest periods of the wheat-producing countries. The international trade in wheat represents under different circumstances from a fourth to a sixth of the world crop of wheat. Other things being equal, each importing nation has a shipment program of convenience rather than of necessity—including elements of custom, climate, port and mill capacity, finance, and transportation—whereby the imports of wheat, joined with the domestic crop, form the moderately varying seasonal supply of bread.[1] With customary adjustments between supply and demand in the world, the importing countries have the first say; they make the offers, and to a sensible extent the buyers rather than the sellers give complexion to the market. When the American winter-wheat crop is harvested and ready for export, the Australian and Argentine exports are tapering off and Canada is exporting the remnants of the old crop; Europe is awaiting the new crop, and summer imports from the United States are desired to help the European importing countries into the new crop year. When the North American spring-wheat crop is harvested, Europe turns to Canada to secure the hard wheat needed to strengthen the soft wheat of her new crop, and there is usually a heavy flow of Canadian exports until the closing of lake navigation. During December–April, when navigation on the Great Lakes is closed, Europe imports Canadian wheat stored at eastern lake ports, continues to take some hard winter wheat from the United States, and draws from Argentina and Australia the remnants of their exports. European imports during the winter tend to be conditioned on the prospects of the new crop in Argentina and Australia. Toward the close of winter, the new Argentine and Australian crops appear on the world market, and there is a heavy flow of wheat from the south into the Northern Hemisphere up to the close of the crop year. With the reopening of navigation on the Great Lakes in April, exports of hard spring wheats are resumed in increasing volume, tapering off through June or July, the last shipments competing with the first shipments of American hard wheat from Oklahoma and Texas. This seasonal sequence of events changes somewhat from year to year with varying import requirements and exporters' surpluses. American exports of durum and Pacific wheat, occasional exports of Indian and Russian wheats, and ex-European imports enter into the picture in a less regular and more sporadic manner. There is an annual seasonal curve of international monthly wheat movement with a high autumnal peak and a second lower peak in the spring, the duration and the height of the peaks and the duration and the depth of the troughs changing somewhat from year to year. By quarters, the movement is more even. The international movement of wheat is orderly, but it is not evenly spaced.

Now, as a rule, it will be the objective of the Farm Board to have the co-operative associations and the stabilization corporation make the best use of these seasonal circumstances and not to undertake forcibly to modify them. To restrain the flow of export wheat when the importing countries naturally desire it, with the hope of building up the price, or to force the flow of export wheat when the importing countries

[1] Using Great Britain as illustration, the seasonal blendings of wheats may be indicated as follows. The domestic wheats are milled largely during the first half of the crop year, mixed with old Australian and Argentine wheats, old and (but mostly) new American winter wheat, and old and new Canadian hard spring wheat, with Indian wheat whenever available. After the first of the year the blends largely consist of new Canadian, Argentine, and Australian wheats, with little domestic or hard winter wheat. Analogous circumstances exist in the other countries of western Europe, modified by the proportions of domestic wheats available. Whatever their utility in the European milling program in a particular crop year, American hard winter wheats are most in demand from August to December. Any undertaking to force exports of hard winter wheats to Europe during January–July is apt to encounter intensified sales resistance.

are less anxious for it, in order to reduce the exportable surplus, are hazardous procedures, likely to provoke untoward competition by other wheat-exporting countries and tending to disorganize the merchandising of export wheats on quality considerations. The undertaking to make some other exporting country "hold the bag" at the end of the crop year is certain to leave us "holding the bag" occasionally or possibly frequently. Each exporting country is endeavoring to sell its products, on the basis of comparative qualities and comparative c.i.f. prices; the importing countries distribute their purchases partly on the basis of price and partly in adjustment with their domestic circumstances.

The co-operative associations will have possession of the export wheats belonging to the fraction of the crop which they control. They, or the stabilization corporation, may also have possession of export wheats purchased from non-members. Export wheats purchased from non-members would, as a rule, be best secured through accepting delivery in December, March, and May on wheat futures purchased during the previous July–September, which deliveries would automatically bring in wheats of export grades.

The experience of the Canadian pools seems to indicate that there is a field abroad for what may be termed opportunistic merchandising of wheat. By this we mean that those in control of our export wheats should not rest content with accepting cabled offers for contract-grade wheat, but should have selling agents abroad developing a merchandise policy, based year after year on the varying qualities of our export wheats. The success attending the efforts of the Canadian pools in the disposal of wheat grades Nos. 5 and 6 during the last crop year suggests that there is something in a centralized export policy directing an organized selling campaign in importing countries.

In merchandising abroad the surplus of American wheat, the wheat stabilization corporation would encounter certain influences to which reference has been made under different contexts and which deserve a conjoined statement. These influences, deterrent in their direction, have been outstanding only since the war.

1. *Type of wheat exported.* The different world wheat markets desire certain types of wheat, and they wish these if possible representative of the type, of fair quality, and uniform. For the most part, since the war, our exports have fallen short of these expectations. Our irregular exports of hard spring wheat (excluding durums and Pacific wheats) contain little of Marquis or any other outstanding variety of hard spring-wheat type. Instead, the exports consist largely of mixtures of inferior varieties. Of durum wheat the European market desires amber durum, but we raise largely red durum instead. The soft white Pacific varieties, for the most part, do not conform to the type desired in the soft wheat. Our exports of hard winter wheat contain varying amounts of Turkey Red and Kanred wheats, but incline more and more toward yellow rather than red hard winter wheat. The exportable surplus of soft red winter wheat is exceedingly mixed and nondescript. In short, the exportable wheats vary greatly as to type. In contrast with this, the exportable wheats of Canada, Argentina, and Australia for the most part conform to established types, and these in most years of high grade.

2. *Quality of wheat.* Within the type and in the varieties exported, the quality of our export wheats tends to be substandard. This is outstanding in the case of hard spring wheat and red durum wheat; it holds also for soft red winter wheat and to a lesser extent for hard winter wheat. We export on the basis of the contract grade and most of the exports barely grade No. 2 Hard Winter, No. 2 Red Winter, and No. 1 Northern Spring wheat; these export wheats are for the most part mixed for export with the view of just making the contract grade. Viewed as a whole, these wheats are substandard in the United States and are not up to the import standard of Europe; not only are they substandard, but they are not representative of the American wheats consumed at home. These wheats meet abroad the representative and standard wheats of Canada, Argentina, and Australia. The European importer is more or less continuously in the position of contrasting unrepresentative American wheats with representative Canadian and Argentine wheats on the basis of price and utility

in the European milling program. The wheats of Canada are sold on grade; those of Argentina and Australia are sold on the basis of "fair average quality"; and in applying the annual definition of "fair average quality" of Argentine and Australian wheat, the European importers have in effect a voice. American wheats are purchased on the basis of federal grades, under inspection at the ports, against which European importers have repeatedly protested (privately, publicly, and officially) during recent years.

3. *Merchandising practices.* Up to the present, the exported American wheats may fairly be said to have been sold without salesmanship abroad. The importer in the foreign country makes an offer, or the American exporter makes a tender. The American exporter (who may be an American, a Canadian, or the American representative of an importing foreign house) does not search out foreign markets; he is, in effect, a passive exporter on the basis of price. No salesmanship abroad is contributed by representatives of the American Departments of Agriculture or Commerce. In fact, no one is demonstrating American wheats abroad. The European importers are willing to take American wheats when they can secure them cheap for certain purposes; the American exporters are diligent in making export sales when the transactions promise a profit. But that is all.

In the case of the competing wheats of other countries, on the contrary, there is a factor of salesmanship. The sellers of Argentine and Australian wheats and the buyers of those wheats in Europe are closely associated and are often indeed business connections. There is, therefore, in a real sense a selling campaign in Europe on behalf of Argentine and Australian wheat, on the basis of purely commodity considerations. In the case of Canadian wheat, the Pool has representatives in many foreign countries engaged in a campaign for direct sale of Canadian wheat to millers. This is indeed one of the outstanding advantages in the co-operative marketing of wheat, that salesmanship is thus practiced in foreign countries. Contrasting the positions of American and competing wheats, it is not unfair to state the situation as follows: in the United States are export wheats for sale, foreigners can take them or leave them, and the selling prices are frequently influenced by contract prices not closely in line with conditions abroad; in Canada, Argentina, and Australia the sale of export wheats includes a searching out of foreign markets and a program of salesmanship, and the domestic prices tend to reflect closely the prices in Europe. Under a Farm Board, the American wheat growers have the opportunity to develop a foreign selling policy and program comparable with that employed by the Canadian Pool.

4. *The international accounts.* Of the major wheat-exporting countries, the United States alone is a creditor country. Canada, Argentina, and Australia are all debtor countries; they are still actively borrowing foreign capital and have not yet reached the position of mature borrowers. Annually they must make large international payments to cover interest charges, mostly to the United Kingdom and to the United States. Other things being equal and unless the balancing of the international accounts is peculiarly modified by invisible items, these three countries must sell wheat abroad in order to obtain foreign exchange. In particular, they must sell wheat to obtain sterling exchange. American wheat growers do not need to sell wheat to obtain sterling exchange or any other foreign exchange. Broadly appraised, our excess of exports of goods over imports is sustained by, and is largely the expression of, a continuing export of capital. One is justified in saying that, other things equal, the continuing export of wheat from the United States entails a continuing export of capital. In short, wheat growers in Canada, Australia, and Argentina must export wheat in order to pay interest on their debts, while Americans must extend fresh foreign credits or loans, or make investments in order to induce Europeans to take our wheat. The net result of this situation is that Canada, Argentina, and Australia are, so to speak, exporting wheat downhill, while we are exporting wheat uphill. It is very difficult (and it may be impossible), on account of complexity of relations between visible and invisible exports and imports, to prove the direct effect of these

influences on wheat prices and exports. But there can be no doubt that in the broad sense these circumstances work to make Canadian, Argentine, and Australian wheats relatively cheaper to the European than American wheats. If we were a debtor nation, our wheat export problem would be somewhat easier.

B. *As price-influencing procedure.* In addition to controlling the flow of export of wheat on merchandising considerations, the co-operative associations and the stabilization corporation will sometimes need to examine the possibility of modifying exports in the endeavor to influence prices. It seems rather widely assumed that such a procedure would be regularly used; it seems to us more likely that it would be only occasionally employed. Circumstances are conceivable under which restraint of exports or withdrawal from the export market might seem indicated. In the hope of influencing the domestic price of wheat, even at the risk of lowering the world price, or in the endeavor to improve both the domestic and the world prices of wheat, the seasonal outflow of wheat might be modified, exports might be withheld from the current year and transferred into the succeeding year, or export dumping, so called, might be employed. There is a certain contradiction between controlling exports on the basis of merchandising considerations emerging from the qualities of available export wheats and price-influencing procedures which are quantitative and take little or no account of considerations of quality at home and abroad.

At once arises the question to what extent variations in the American exportable surplus influence the world prices of wheat. In theory, if the statistical data were adequate and trustworthy, it would be possible, under certain assumptions, to compute the influence of changes in supply on price; in practice, however, it is likely to be an unsatisfying computation. It may be attempted for wheat in several ways.

According to the first method, one would take the reported wheat crops of the world (including Russia, India, and China) and with certain assumptions in respect of elasticity of demand and supply of substitutes, compute the influence on the level of wheat prices of a stated increase or decrease in the American wheat crop, other things equal; or compute the influence on the wheat price level of a stated increase or decrease in the American wheat crop, in connection with stated variations in the wheat crops of other countries. One would need to elect the wheat price at a particular point as representative of the general price level or compute an index of wheat prices in selected countries. The fact that the wheat crops in different countries enter the market in different months, together with more or less uncertainty on crop estimates and carryovers, introduces obvious difficulties into this computation. So also does the absence of accurate knowledge of the size of wheat crops in China and other countries.

According to a second method, one would take the reported wheat crops of Europe (excluding Russia, but including northern Africa), Canada, the United States, Australia, and Argentina, and with certain assumptions in respect of elasticity of demand and supply of substitutes, compute the influence on the level of wheat prices of a stated increase or decrease in the American wheat crop, other things equal; or compute the influence on the wheat price level of a stated increase or decrease in the American wheat crop in connection with stated variations in the wheat crops of the other regions included in the survey. One would need to elect the wheat price at a particular point as representative of the general price level or compute an index of wheat prices in the regions included in the survey. This method has some advantage over the first method in trustworthiness of statistical data and in mobility of the wheat involved.

According to a third method, one would prepare an estimate of European and ex-European import wheat requirements (on the basis of the wheat crops and supplies of substitutes on the continent) and contrasting these with export surpluses in Canada, the United States, Australia, and Argentina, compute the influence on the wheat price level of stated increase or decrease in the American wheat crop, with certain assumptions in respect to the elasticity of demand and supply of substitutes in the countries involved on both sides of the Equator. The advantage of this method

is that it is a moving estimate, deals with mobile wheat, and expresses the broad inference that the unit of wheat moving in international trade has greater influence on wheat price than the unit of wheat produced in international agriculture.

Selection of point of registration of wheat price represents a difficulty with all three methods, but the price of wheat at Liverpool or London, preferably a weighted price, is better adapted to the third method than to the first or second. That the price of wheat is a range and not a point constitutes a difficulty with all three methods, though one least prominent with the third method. The influence of a stated crop variation—for example, 200 million bushels—on the American price would be least when computed according to the first method and most when computed according to the third method; probably the third method would give too high a result and certainly the first method would give too low a result.

It is possible, as supplementary to the above, with similar computations to estimate the influence on the American wheat price of variations in the American carryover; but since variability of carryovers is less in bushels than variability of crops, and the trustworthiness of the data probably no better, such computations would be more hazardous than in the case of computations applied to variations in the crop.

The effect of interrelation of domestic with foreign prices is a balancing of consequences. Being an exporter exposes us to the world price, which probably more often means a depressing than an elevating influence. But it also means a stabilizing influence, since the world price of wheat is apt to be more stable than the price in any one country. Large crops of wheat do not tend toward low farm returns, as is the case with crops on a domestic basis. Thus wheat differs from most other crops on a domestic basis or where we make the world price, as in the case of cotton. The returns on the wheat crop rise and fall with the domestic crop and are not reversed by climatic surpluses, so that the relation to a world price has thus sometimes a relative advantage. To curb price fluctuations provoked within the season (or from one crop year to another) by crop developments at home or abroad, would represent a difficult problem. In so far as the situation were international, acquiring or releasing domestic stocks of wheat and diminishing or increasing the carryover out of the crop year might prove to be relatively weak weapons. Interseasonal price movements have such varying factors that it is scarcely an exaggeration to say that each pronounced interseasonal price variation stands without precedent. In some crop years the functions of the stabilization corporation would be one-sided and limited to protecting wheat growers from the results of international circumstances that would otherwise eventuate (naturally and without manipulation) in a lower world price of wheat. In other years, the objective would be positive, to utilize as far as possible an international situation to the advantage of the domestic wheat price. Probably the transitions from one crop year to another crop year of the same wheat price level could be made more smooth by a consistent policy of the Farm Board applied to regional stocks and carryover; but the net effect of this on farm prices of the two years could hardly be expected to be large.

The rate of export tends to influence the price. Since the export wheat of the United States is one of the factors in determining the Liverpool price of wheat, it is urged that the Liverpool price might be modified by controlling the flow of American export wheat. If export of wheat could be restrained during the autumn, could not Europe be compelled to draw more heavily on domestic supplies with consequent raising of price? In short, would it not be possible by a centralized exporting policy to take advantage of varying circumstances in Europe rather than allow Europe to take advantage of marketing pressure during the autumn in North America? In certain years this would undoubtedly be feasible, with the co-operation of the Canadian wheat pools; but in other years, the outcome would be not merely without profit but would entail heavy losses. In most years there remains in each exporting country of prominence an exportable carryover. If American exports were restrained, this might simply have the result of facilitating the exports of other countries and leave in this country at the end of the crop year a disproportionate carryover of exportable

surplus. Certainly, effective export tactics could hardly be employed by the United States without the co-operation of Canada. Whether North American wheat could be employed as a unit in price-raising tactics directed against Europe, with or without the co-operation of Argentina and Australia, is a hypothetical inquiry that need not detain us here.[1]

It is easy to adduce illustrations of kaleidoscopic changes in the export situation. In May of this year, with Kansas City wheat below a dollar, the carryover of hard winter wheat represented something akin to a catastrophe to that region. In July, with Kansas City wheat over $1.40, the same carryover was transformed into a welcome addition to the new crop, and it is likely that the carryover, which is largely substandard wheat, will sell for as much as the high-grade wheat of that crop sold for directly after the harvest. It is at once the changeability of prospects and the hazards of losses that make control of exports as price-influencing procedure so enigmatic.

Export Dumping Again

The words "export dumping" as applied to wheat are employed in a loose and unconventional sense. Export dumping of manufactured goods means selling abroad the articles at a manufacturers' price lower than that secured for the identical goods remaining in the home market. The so-called export dumping of wheat would be concerned with a fraction which for the most part is not identical with that consumed at home. Secondly, it does not follow that it would be sold abroad below the lowest figure received for some of the identical wheat in some of the domestic markets. Export dumping of wheat really implies hunting up foreign markets and facilitating the sale of surplus wheat abroad for whatever it will fetch, quite irrespective of the domestic market. The wheat which is disposed of abroad by so-called export dumping could be sold on the domestic market for feed. When disposed of in export trade for what it will fetch, this will be more than what it could bring for feed on the domestic market, but less than the price of a comparable wheat. When the Canadian pool searched out, in various parts of the world during the crop year 1928–29, markets that were able to utilize No. 6 wheat in conjunction with their other wheat supplies, this was not a dumping in any correct sense. But the wheat exporters of Argentina doubtless held it to be export dumping.

Whenever the stabilization corporation is weighing the possible effect of export dumping of wheat on domestic price of wheat, it will need to formulate a number of estimates:

1. What effect would a stated export dumping have on the domestic terminal price?
2. What is the leeway of protection afforded by the tariff wall?
3. What effect would the change in the terminal price have on the farm price?
4. What effect would the operation have on gross farm income?
5. What effect would increased domestic price have on domestic consumption?
6. What would be the direct costs and losses of the dumping operation contemplated?
7. What effect would the stated dumping have on the world price of wheat?
8. What effect would the changed world price have on the world consumption of wheat?
9. How would the corporation's direct loss and cost of dumping compare with the indirect gain to growers through elevation of domestic price?
10. What would be the effects in the subsequent crop year?

Despite these formidable questions, viewed directly as an example of computable relations in the equation of supply and demand in price, it seems clear that under certain assumptions export dumping of wheat would operate effectively to raise the domestic price level.[2] But we take it that in

[1] It is instructive to note that consumers of import wheats in Europe contend that the margin between f.o.b. price in exporting countries and mill price in Europe is excessive, just as producers in exporting countries contend that the margin between farm price and f.o.b. seaport price is excessive. Attention was not long since directed to this point in the course of a British investigation into wheat prices by the Linlithgow Committee. The charge failed of substantiation, and it was made clear that what may be termed the importer's margin (including ocean freight, insurance, interest, commissions, handling charges, and middlemen's profits) could not be regarded as excessive.

[2] Cf. Mordecai Ezekiel, "A Statistical Examination of the Problem of Handling Annual Surpluses of Nonperishable Farm Products," *Journal of Farm Economics*, April 1929, XI, pp. 212–14.

practice, under the complexity of circumstances attending the procedure, the effect would be less computable and ponderable, though it is to be granted that, other things equal, dumping wheat on the foreign market holds larger promise for price increase than carrying wheat on the domestic market from one crop year to another. The losses incurred in export dumping of wheat would of course need to be absorbed (to which we have given attention in an earlier section), and the indirect gain on the price of the large amount of wheat domestically consumed would need to be contrasted with the direct loss on the relatively small amount of wheat dumped into export.

Export dumping in any form carries with it the danger of provoking reprisals. The subject of foreign reprisal in retaliation against dumping was recently discussed in WHEAT STUDIES in connection with the export debenture.[1] There is some distinction between export dumping with the losses reflected to the producers of the commodity and export dumping in consequence of governmental subsidy, the latter being regarded in international circles as the more heinous offense. But in actuality, such distinctions may easily be lost sight of. Urban workmen in the industrialized countries of Europe would welcome export dumping of American wheat by a stabilization corporation, an attitude shared by the capitalists who employ them and the exporters of European goods, without concern as to who absorbs the export losses. Such export dumping would be resented by the landlords and peasants of the same European importing countries, and the agrarian class possesses in many countries singularly effective political power. It was striking to observe how promptly the import duties on wheat were raised in France, Italy, and Germany with the sharp decline in wheat prices prior to June of this year, and it is possible that one of the effective arguments employed was that such action was necessary to protect wheat growers from the assumed results of the lowering of the export wheat freight rate in the United States.

Finally, retaliation of one type or another might be provoked in the competing wheat-exporting countries. We take it for granted that some sort of understanding will be established between the American wheat growers' co-operative associations and the Canadian wheat pools that will preclude anything resembling export trade wars. Both countries are engaged in the export wheat trade and the commercial interests of wheat growers in both countries are conditioned on getting their surpluses of wheat sold. At the same time, we take it there will be enough class solidarity to prevent export dumping by Canadians or Americans, undertaken without cognizance of the other party and of an obviously discriminatory character. In the case of Argentina and Australia, the same inferences cannot be drawn. The Australian wheat growers are again endeavoring to revive state pools. If Australian wheat export policy should again be determined by growers, some understanding with Canadian growers might be arrived at, though the reaction of Canadian butter producers to the Australian plan of export butter control was in the opposite direction. Argentine export policy is really in the hands of the European importers, despite occasional gestures to the contrary on the part of the Argentine government.

Centralization of policy and management in wheat-exporting countries will bring European wheat importers closer together, make them less competitive with each other, and tend to promote group solidarity. In their reactions, European importers of wheat will be supported by European importers of other raw materials and by shipping interests. Western Europe lives by exports of finished goods made from imported raw materials, turned out by workmen fed to a large extent on imported foodstuffs. Cheap bread is economically as important to the manufacturing classes of Europe as higher-priced wheat is to American farmers. With this background, it is clear that reprisals against export dumping of wheat, whether dumping in fact or merely in appearance, are not to be lightly dismissed as academic discussion. Reprisals are based on political as well as on commodity considerations; often the former embody the purpose and the latter merely the occasion of reprisals.

[1] "The Export Debenture Plan for Wheat," WHEAT STUDIES, July 1929, V, 336–40.

VII. ADJUSTMENT OF SUPPLY TO DEMAND

There would be little purpose at this time in entering into appraisal of the relation of planting of wheat acreage to price of wheat, all the more because the new factor of price policy will enter the situation as an unprecedented variable. In view of the circumstances attending the development of the country since 1870, we do not believe that coefficients of correlation between wheat price and wheat acreage could be relied upon to forecast the influence of wheat price on wheat acreage in the near future. In the press one reads the most divergent views. On the one hand, the influence of price of farm products on farm practice is so exaggerated as to give the picture of farmers without plan of rotation modifying each year's practice in accordance with the previous year's prices. On the other hand, it is urged that the majority of farmers cannot shift acreage with prices, but are tied down to financial commitments or follow an unvarying scheme of individual management. Also, it is commonly asserted that low wheat prices increase wheat acreage as much as high wheat prices, since many farmers, facing irreducible cash commitments, must increase acreage with low prices in order to secure the necessary cash income.

We take it that the Farm Board would adopt the common-sense view, at once realistic and orthodox, that higher price and policy of higher price would tend to influence wheat acreage in the direction of expansion, especially as wheat is a prominent cash crop. There would be tendencies to turn land to wheat from other less promising cereals, to direct rotations more toward wheat, to put some grass land into wheat, to put under wheat some untilled land within farms, and to expand wheat growing in new regions. The admission that higher price would tend to stimulate production, and that some provision for restraint must be kept in view, was well stated by Senator Norris in the Senate on April 30: "Any legislation to increase the prices of farm products will tend to increase production. No one denies that. It is true of every protective tariff ever adopted. There may be more danger in this instance, and therefore I think we should be willing to put a penalty on overproduction."[1]

The rejoinder will be made that the Farm Board will direct attention to improvement of prices of all cereals, which will tend to prevent growers' intentions from being diverted in the direction of wheat. We are convinced this is an overdrawn expectation. As between wheat, rye, barley, oats, and corn, wheat is by far the easiest cereal to approach with improvements in merchandising and price. It is difficult to picture the organization of a rye growers' co-operative association, an oat growers' co-operative association, a barley growers' co-operative association, or a cash corn growers' co-operative association, in view of the regional relations of production and of the large proportion of the crops used locally and not entering the public markets. Rye might be handled by the spring-wheat growers' co-operative association. It is difficult to picture a coarse grain co-operative association extending beyond the upper Mississippi Valley states. In the present position of animal husbandry and with the gradual replacement of work animals by tractors, the commercial prospect in raising coarse grains is in most years and in most regions definitely below the commercial prospect in raising wheat, on soil adaptable both to bread grains and to coarse grains. The Farm Board would certainly adopt the view that where grain growers were considering alternative attractions, the decision would tend in the direction of expansion of wheat acreage relative to acreage in other cereals.

In our judgment, the success of efforts to improve the price of wheat consistently hinges on adjustment of supply to demand. If, under the operations of a Farm Board, wheat growers are left to follow their own

[1] A comprehensive study of correlation of wheat acreage with wheat prices, with allowances and adjustments for other varying factors, has never been published. But Bean has remarked that "in general the acreage in grains responds more to high prices than to low." (L. H. Bean, "The Farmers' Response to Price," *Journal of Farm Economics*, July 1929, XI, 381.) In any event, farmers' responses to naturally occurring variations in wheat prices would tend to be less pronounced than to prices plus a governmental price policy.

devices, we can hardly hope that the price-influencing procedures of the wheat growers' co-operative associations or the stabilization corporation would have a substantial continuing effect. Still more would a policy of elevation of the price level result in expansion of acreage. For reasons that are obvious, factors of distribution bearing on the price of wheat have been given great prominence in political discussions, while factors of production bearing on the price have been subordinated. It is our considered view that factors of production have had more to do in the establishment of unsatisfactory wheat prices than have factors of distribution.

In matters of manufactures, adjustment of production to demand is usually easier than adjustment of demand to supply. In the discussions on farm relief it has been more or less predicated that adjustment of production to demand is so inherently difficult as to be practically impossible and that relief must be sought through improvement in distribution and expansion of demand. Unfortunately for wheat growers, the relatively inelastic nature of the demand for wheat does not fit in well with this formulation. For our part, we are convinced that substantially higher prices for wheat are to be routinely secured in the United States only when some restraint on production, however devised, is added to improvement in quality and in distribution, and supplemented by search for new demand.

If one will regard the wheat-growing states, everywhere one finds evidence of submarginal production of wheat—production on submarginal land, or with submarginal methods, or by submarginal farmers. The extent and circumstances vary from state to state. In some places, wheat is a choice of evils as a rotation crop; in other places it is merely the least undesirable of the small grains; in some areas the straw is almost as valuable as the grain. In some places it is a form of one-crop farming from which no escape is readily perceived. In some regions, where wheat was once the crop of choice, through soil exhaustion it has become a crop of makeshift. Considerable wheat is grown on soils relatively unadapted to wheat for reasons of climate, rainfall, frost, and other hazards. A survey of the expense of raising wheat in the different regions indicates that a considerable but variable portion of the crop is raised at exceedingly heavy costs, ranging beyond possible prices. It is easy to recommend diversification, but this proceeds slowly on account of the limited availability of adaptable animals and plants of selected strains and remunerative outturn.

Also, a surprising proportion of the crop is submarginal in quality. We raise every year large amounts of wheat of undesirable varieties, often mixed. In some regions, the wheats of all types and varieties tend more or less toward low grade. It is a fair statement that in different years from 100 to 300 million bushels of wheat raised in the United States are unmillable for the purpose of producing flour good enough to meet the specifications of the high-grade trade. It is for the most part through prices of these culls of the crop (culled by the American mills) entering export trade that the world price is reflected back upon the domestic price of wheat. The exportable surplus of American wheat is one of the important factors determining the world price of wheat; and the wheat in our exportable surplus (apart from durum and Pacific wheats) is for the most part and in most years sold low in the range of world wheat price. Also, it is the fraction of the crop yielding relatively low returns to growers.[1]

Just how the wheat growers' co-operative associations are to restrain the wheat acreage of their members cannot be indicated. The non-member wheat acreage remains entirely independent. We are unable to envisage any plan that would control production automatically. We cannot interpret the relative effects of yield and acreage on outturn as suggesting the possibility of automatic adjustment of production to price. Policy of restraint and of adjustment must become precept; precept become farm program. Producers' organizations have so seldom attempted to restrain production that few precedents exist. But if the necessity of such restraint were adequately realized, it ought to be possible to devise ways and means to bring growers to the conviction

[1] For a suggestive presentation along another line, see F. V. Waugh, *Quality as a Determinant of Vegetable Prices* (New York, Columbia University Press, 1929).

that restraint is necessary if better prices are to be secured. Properly prepared statistics dealing with supply, demand, and prices of wheat must furnish the background for control. If submarginal growers of wheat could be convinced of the futility of hoping for such improvement in price as might make their operations profitable, much would be gained. Also, much would be gained if bankers, country merchants, and realtors could be convinced that wheat growing can never be made profitable on much land now devoted to this grain. A movement for acreage control can never be spectacular; curtailment of operations is unpopular in the aggregate and to the individual. If abandoned or foreclosed wheat land could in some way be withdrawn from the land market and returned to the public domain and withheld from reissue (except perhaps for forestation), this would represent a major alleviation in some regions.[1]

One must not undervalue the possibilities of expansion of new wheat acreage in the hard winter-wheat states. For sound agricultural reasons, this expansion is under way and will be stimulated by a policy of price improvement. In western Nebraska, Kansas, and Oklahoma, eastern Colorado and New Mexico, and northern Texas lie many million acres of virgin land adapted to the raising of high-grade hard winter wheat with modern methods. It is essentially one-crop farming; the land is plowed with tractor power, the wheat is cut and threshed at one operation with the combine, and in view of the early date of the harvest the replowing can be so accomplished as to keep down weeds, conserve moisture, and act as a season of fallow. It is essentially large-scale wheat growing, or co-operative plowing, planting, and harvesting of smaller units. Caution must be used in the use of the combine to avoid the effect of moisture in bin-burning, and this will entail to some extent modification of harvesting practices, cleaning and conditioning of the wheat, and farm storage in ventilating bins. The special adaptations necessary to control the effect of wheat moisture and weed moisture on wheat quality will reduce to some extent the large savings accomplished by tractor plowing and combine harvesting. But with full allowance for adaptations necessary to conserve quality of wheat, the labor costs per acre are low and, for the time being, the interest costs per acre are low, since these lands have thus far escaped inflation of prices. The product is high-grade hard wheat, and it is illogical to expect this development to be postponed because elsewhere in the United States poor farmers with poor methods applied to poor lands raise poor wheat.

Restraint of acreage, i.e., control of quantity of production, is only one part of the control demanded by the cumulative circumstances of our situation. The other part is control of quality. Gradually it is becoming clear to what large extent, and for what reasons, the quality of American wheats has deteriorated. Also, flour standards have been raised. Premium wheats are now required to make the patent flours that two decades ago could be made from country-run or elevator-run wheat. Active wheat improvement associations are now established in both the spring- and winter-wheat belts, directing their energies to careful appraisal of the causes of the continuing deterioration, and the determination and installation of corrective procedures. In part, improvement is to be expected only as result of plant breeding and seed selection. The harvester-thresher combine has created new problems for the wheat breeder and for the distributor. It will be necessary for wheat growers' co-operative associations to take an active part in the work on wheat improvement, to furnish seed to members and in every way to favor the use of selected seed of good varieties, planted and harvested with approved methods, and thus to endeavor to increase the proportion of high-grade wheat and diminish the amount of low-grade wheat raised in the country. The weed problem demands intensive attention. The identical problems have arisen even on the newer wheat lands of the Prairie Provinces of Canada, though in a

[1] It is highly significant that H. C. Taylor, distinguished farm economist and insistent spokesman for agriculture, has recently issued an appeal for a back-to-town movement. "Agencies which tend to hold an excess of farmers on the land should be displaced by agencies to facilitate the movement of the surplus farm population into other occupations in order to maintain a proper balance between rural and urban population." ("The New Farm Economics," *Journal of Farm Economics*, July 1929, XI, 365.) Such a declaration constitutes a striking departure, in the light of the traditional land settlement policy of the country.

less acute form than in this country, and the Canadian pool is putting forth active efforts on behalf of wheat improvement. Parenthetically remarked, compared with the pre-war period, wheat has deteriorated in Russia and in the Danubian region.

In his report on manufactures, published in 1791, Alexander Hamilton raised the question whether an improved agriculture were not preferable to an enlarged agriculture. The question still holds. The objective of wheat growers' associations ought to be an improved and remunerative agriculture, not an overextended and unremunerative agriculture. And this ought to be the objective, irrespective of any concern over the statistical wheat need of the world or of the hypothetical pressure of population on food supply. Just how a policy of acreage control is to be co-ordinated with both the domestic situation and the world supply and price of wheat, is not obvious. We may be sure that this crucially important adjustment will not occur automatically under any plan of surplus control.

How would the Farm Board proceed to suggest adjustment of production to demand? The wheat stabilization corporation would not be involved; the procedures would lie between the Farm Board, the advisory commodity committee, and the regional wheat growers' co-operative associations. If wheat marketing is to be farmer-controlled, it follows that wheat acreage also should be farmer-controlled. Difficulties will obviously arise between regional viewpoints. In particular, wheat growers in the Pacific states, who do not market their grain on the large grain exchanges and who dispose of their exportable surplus largely in the Orient, might object to accepting a program of acreage restraint based on conditions east of the Rocky Mountains and related to the European market for wheat. In each region, low-cost producers will feel like rejecting their proportional share of acreage reduction and high-cost producers will feel that accepting their proportional share of acreage reduction will put them out of business. In each region, producers of high-grade wheats will feel that restriction of acreage ought to apply proportionally more to low-grade wheats than to high-grade wheats. Insurance companies and banks which take over abandoned wheat lands will wish to know what is to be done with them. To a critical extent a contest between class solidarity and traditional individualism is involved in a program of adjustment of wheat supply to demand. But if wheat farmers have suffered as much as their spokesmen have contended, there should be some prospect of success in such adjustment.

Adjustment of production means co-operative adjustment of acreage. Adjustment of acreage is easy to suggest, difficult to plan, and still more difficult to execute. During the war the government supervised a state-by-state survey of wheat acreage for the purpose of increasing production. The recommendations of acreage to be planted to wheat at that time dealt largely with the marginal acreage, in the direction of increase. The adjustment in acreage called for now would deal largely with the marginal acreage, in the direction of decrease.

It is not difficult to distinguish the marginal elements in wheat growing. A survey in any state where wheat growing is at all prominent will reveal wide variations in costs per acre and still more per bushel. In some regions wheat is practically the only cash crop, the product of one-crop farming, with or without fallowing, and usually attended with rapid deterioration of the land and often with erosion or blowing of soil. In other areas wheat is the important, or one important, cash crop in an established rotation in diversified agriculture. In other areas, wheat is one of the small grains in a scheme of rotation, and scarcely more important than rye, oats, or barley. In some areas wheat deserves to rank no higher than a feed grain, in other areas it produces regularly a premium crop. Despite the realization that the facts are known in each state, it would seem advisable to have a careful survey made to determine the place of wheat growing in the agriculture of each state from the standpoint of a program of adjustment of acreage which would result in less wheat but better wheat. Such an appraisal, state by state, carried out with adequate consideration of the milling qualities of wheats, and careful approximation of costs of production, ought to put the Farm Board in position to enlighten wheat growers as to the commercial value of the crop.

General Considerations Applying to Adjustment of Wheat Production

So far we have dealt with considerations applicable to the individual wheat grower. Two general considerations exist which apply to the question of adjustment of wheat production to demand on a country-wide scale, and by many these will be interpreted not to favor but rather to make questionable a program of gross reduction of the American wheat crop. These are the relation of gross wheat income to the wheat crop and the relation of American wheat acreage to world wheat acreage.

It is a common statement that large crops often bring a smaller gross return than small crops. In this respect each crop must be studied by itself. Small crops of potatoes and of cotton, for example, sell for more money than larger crops.[1] According to the last report of the Secretary of Agriculture, 48 million hogs sold in 1928 for almost 200 million dollars less than the amount received for 41 million hogs in 1926. These examples will suffice to illustrate the inverse relationship between volume and value in some agricultural crops. But this does not hold for wheat. The money value of the wheat crop rises with the volume of the crop. As Black has stated it,[2] "*As for wheat, crops larger than the present large crops would sell for still more money.* This would continue until the United States' crop was so large that it overwhelmed the world's markets."

Not only this, but in the case of wheat the same situation holds in respect to the relation of surplus to net farm income. G. M. Peterson[3] has computed and charted for a number of farm products the relation of supply to total farm value and costs. In the case of potatoes, cotton, corn, and oats, increase in supply brings losses; in the case of wheat, increase in supply, i.e., in surplus, brings gain. Stated directly for weather surpluses and deficits, the total value and total gain above cost for wheat increase as United States supplies or yields increase with constant acreage. The distinction between wheat and the other cereals in respect to relation of volume to value is a point of importance too commonly overlooked.

The second consideration is drawn from the relation of American wheat acreage to world wheat acreage. This is an intimate interrelation, supplies reacting on prices in both directions. Here, again, the coarse grains occupy a different position since the war. With allowance for occasional years of heavy export of corn, it is not too much to say that our overseas exports of corn, barley, and oats are casual, there is no close interrelation between American coarse grain acreage and the world coarse grain acreage; the world prices for coarse grain are not continuously and effectively reflected to coarse grain prices in the United States. In the case of wheat, we are seasonally on the export market, the wheat acreages at home and abroad influence each other, and world prices of wheat are to a considerable degree reflected back to American wheat prices. There is a trend of expansion in wheat acreage in the world as a whole; expansion of wheat acreage in this country will only be additive to expansion of wheat acreage occurring outside of the United States, while contraction of wheat acreage in the United States would serve only to moderate the effect of expansion in wheat acreage outside of the United States.

To condense a statement that otherwise would demand elaboration and qualification, let us say that it is the short world crop that tends to make the high domestic price, relatively irrespective of the size of the domestic crop; the bumper world crop tends to make the low domestic price, relatively irrespective of the domestic crop. The full effect on domestic price of restriction of domestic production would only be attained with the crop reduced to something like the domestic basis, leaving a seller's market behind the tariff wall.

Each year, and over a period of years, the Farm Board must accept some tentative basis of price, some forecast of world trend of wheat acreage and endeavor to suggest to American wheat growers the most favorable, or the least unfavorable domestic adjustment in relation to foreign contingencies. With the one hand a Farm Board

[1] Cf. J. D. Black, *Agricultural Reform in the United States* (New York, McGraw-Hill, 1929), pp. 95–112.

[2] *Op. cit.*, p. 105.

[3] G. M. Peterson, "The Relation of Annual Weather Surpluses to Net Farm Incomes," *The Annals of the American Academy of Political and Social Science*, March 1929, CXLII, pp. 391–401.

would endeavor to shape American acreage to fit developments in world acreage; with the other hand, the Board would endeavor to modify carryover and export to fit developments in world supplies.

It is overdrawn to imply that the American exportable surplus plays so secondary a rôle in the world price. With an international trade of 800 or 900 million bushels, for example, there would be a substantial difference between the United States contributing 200 million bushels toward an easy international adjustment between supply and demand and contributing 100 million bushels toward a difficult international adjustment between supply and demand. The reflection of world price to domestic price presumably varies with variations in size of the American exportable surplus. Furthermore, when domestic crops are somewhat shorter, and the exportable surplus correspondingly reduced, the scope of choice of millers is restricted, competition between mills is intensified, higher premiums are secured, and a larger proportion of the crop enjoys behind the tariff wall a price above the world price. Thus, with full recognition of the influence of world price on domestic price of wheat, restriction of domestic production would nevertheless be effective in the direction of raising domestic price. But not until domestic acreage approaches domestic demand will contraction of domestic acreage behind the tariff wall tend to make domestic price independent of world price. This illustrates the peculiar difficulty attending effort at adjustment of production in one country when the price depends on circumstances in many countries.

There is no purpose in harboring illusions. Disregarding foreign conditions, the most effective influence on wheat price would be secured through lapse of 10 million acres now devoted to low-grade wheats. The next most effective influence on price would be to have every new acre of wheat planted on soils adapted to raising high-grade wheat balanced by the lapse of an acre of wheat now being planted on soils adapted to raising low-grade wheat. What one must fear will happen is that planting on new land adapted to raising high-grade wheat will expand, while the planting of wheat on land not adapted to raising high-grade wheat will not contract. The net result, one must fear, will be gross expansion of wheat acreage, enlargement of crop under favorable conditions, with some improvement in the proportion of high-grade wheat. The adjustment of production to demand in the case of American wheat is unfortunately just as difficult as it is desirable. It involves a sort of guidance of farmers which may reasonably be expected to prove one of the principal tasks of the Farm Board. Says Ezekiel, "Great progress is being made in the job of carrying the gospel of economic facts to farmers, and still more remains to be done. It does seem, though, that further development, localization, extension, and application of facts aimed at the proper direction of production, will in the long run prove to be the most effective means that can be used to 'settle the farm problem.' "[1]

VIII. CONCLUDING OBSERVATIONS

The Agricultural Marketing Act is the inauguration of a definitive national policy in agriculture. This policy embodies the reorganization of marketing and rationalization of distribution of agricultural products. In our view, the net gains to producers will become gradually effective. Price stabilization, strictly construed, would promise no result of substantial proportions; price stabilization, as the word is commonly employed, is really a euphemistic synonym for price elevation. Price elevation, in the specific sense of enhancement of domestic price level over the world price level, a differential price elevation in short, does not lie within the compass of the Act. It is at this point that the Agricultural Marketing Act is basically distinguished from the export debenture and the equalization fee, which were designed to aim at an elevation of the domestic price level over the world price level. Improvement in the price of wheat is

[1] Mordecai Ezekiel, "A Statistical Examination of the Problem of Handling Annual Surpluses of Nonperishable Farm Products," *Journal of Farm Economics*, April 1929, XI, 220.

expected under the Act, especially in the weighted farm price; but improvement in the farm price is a different thing in meaning from differential elevation of the domestic price level, even though the net gains to farmers in dollars were the same in the two cases. In the introduction, applied to wheat, we have sought, in connection with a brief statement of the position of the wheat grower, to indicate the meaning, the limitations, and the qualifications of the term "price stabilization," which we infer would be attached to it by an administrative farm board, vested with the execution of the Agricultural Marketing Act.

We gather it to be the intent of the new legislation that representative wheat growers' organizations should be organized before proceeding with operations in relation to wheat. These, in our view, should be four in number, determined by the regional characteristics of American wheat growing. They will represent more than mergers of existing detached co-operative associations and farm elevator companies. Since circumstances permit of strategic localization, the inclusion of half the crop would promise effective control. One general advisory commodity committee follows next, in order of organization. A wheat-stabilization corporation, so-called, would carry on the major functions of the operation, at once the instrument of the co-operative associations and of the Farm Board. In our view, the coarse grains ought not to be included in the operations of the wheat-stabilization corporation; if operations in respect of coarse grains are thought desirable, these deserve a separate organization. Rye would be included with wheat. In our view, a great deal will depend upon the influence the Farm Board has on the co-operatives, and upon the reflection of representative opinion from the growers up to the Farm Board.

The definition of surplus is so fundamental in the handling of the wheat crop that the Board will need to appraise the surplus from all points of view. The Board will decide between indirect and direct procedures in dealing with the wheat surplus. We have sought to emphasize the practical meaning of "economic" surplus as distinguished from physical surplus. The distinction between acreage surplus and climatic surplus seems to us of less importance, in part because wheat is not a crop in which large outturn results in lower gross return than lesser outturn.

A number of general considerations emerge regarding the organization of wheat growers' co-operative associations as mergers of producers for the taking over of distributive functions. It seems important to insist that the transition should be accomplished without destruction of capital investment or loss of managerial ability. In our view, the grain exchanges of the country should be conserved and not demobilized. We regard trading in futures as just as important under the new order as at present. Indeed, in our view, a wheat stabilization corporation would be in position to employ the grain exchanges in the commercial interest of the grower to an extent not now possible. We have sought to emphasize the view that the merchandising operations of the stabilization corporation and of the co-operative associations would be continuous, though modified by crop variations; manipulation of the carryover of wheat and export dumping of wheat, on the contrary, we regard as measures involving hazards not lightly to be taken, but rather to be reserved for exceptional circumstances, such as are in the nature of emergencies.

So much has been written of the supposed advantage of carrying and holding wheat, thus modifying the marketing movement through the crop year and from crop year to crop year, that the known costs and prospective gains in carrying wheat become a topic of special importance. Since a strict mathematical treatment of the question is not yet possible, the Farm Board will need to give the subject a realistic appraisal. In our view, the term "orderly marketing" is a misnomer; the seasonal course of wheat marketing rests on sound grounds. The gains to be anticipated will come from profits in operations and increased efficiency in merchandising practice, rather than from drastic alterations in the rate of movement of wheat to market. There is, however, in connection with centralized marketing, a scope for what may be termed "opportunistic tactics," which belong to and can only be exploited by large-scale operations.

The profit and loss accounting will be an

item of outstanding importance to the Farm Board. Despite the wide leeway in powers accorded to the Board in an act that is permissive rather than mandatory, it was clearly the intent of the Congress to guide and to aid agriculture in reorganization, not to salvage the involvements of the past or to pay losses in the future out of public funds. Therefore, correct accounting will be necessary in order to keep all positions clearly revealed. In its relations to the stabilization corporation and the co-operative association as lender to borrower, the Board must aim to make the operations those of a going concern, run for profit. Only with the maintenance of a sound fiscal viewpoint, will soundness in merchandising practices be maintained. One of the objectives of loans to co-operative associations is to enable them so to reorganize and rationalize their affairs as to enable them to become independent of the revolving fund and maintain their operations with commercial credits.

Following this, we have endeavored to indicate the price influences and procedures in trading practices available for wheat. Regarded strictly as merchandising procedures, it is possible to picture them being applied to all wheats, or to representative wheats only, or to substandard wheats only. Precedents and analogies, drawn in part from other commodities, are available for all three schemes. Naturally, the apparent advantage of any one scheme would vary from crop year to crop year.

To secure for growers full premiums for quality, to control the carryover in the merchandising interest of the domestic market, and to control the flow of wheat to export from the standpoint of the domestic market would represent practical problems recurring each year. Control of the carryover from one crop year to the next, and control of the flow of wheat into export, from the standpoint of wheat price level in the United States and in the world, as related to world wheat crop, would represent a different problem, a problem larger and more difficult and attended with serious hazards, one of which would be reprisals by foreign countries. We take it that the Farm Board would enter on massive manipulation of the carryover and massive export dumping only under exceptional circumstances, if it chose to do so at all.

Finally, we have considered in some detail the question of adjustment of wheat supply to demand. We regard expansion in wheat acreage, which we infer is likely to eventuate when the growers first react to the social policy embodied in the Agricultural Marketing Act, as the occurrence most to be feared. An early and continued enlargement of wheat acreage would jeopardize the reorganization of marketing and rationalization of distribution of wheat. It is the necessity of acreage restraint that makes representative co-operative organizations so imperatively necessary. There is much submarginal cultivation of wheat that has no commercial *raison d'être;* we raise large amounts of inferior wheats that find no remunerative market in the world. But desirable as is adjustment of production to demand, there is no purpose in glossing over the difficulties, which we have attempted to sketch in some detail.

What one expects from the Agricultural Marketing Act under the operation of the Federal Farm Board and its subsidiary agencies depends in part upon one's political philosophy, just as this holds true for the Federal Reserve Board, the Federal Trade Commission, and the Interstate Commerce Commission. In part, however, what one expects from the Farm Board in the operations with a particular agricultural commodity depends upon one's familiarity with the commodity in question, its relations of production, distribution, and consumption. The question is perhaps more largely realistic than theoretical. No one can make even a tentative forecast without qualifications; but the qualifications themselves tend to be imponderable.

Much depends upon the objectives envisaged in respect to the wheat price desired and price-influencing measures to be regarded as attainable. Enhancement of wheat price level, improvement of wheat price within the wheat price level, and stabilization of wheat price, while overlapping and to a degree inseparable, are essentially different things when strictly construed. To those who are looking for substantial elevation of the domestic wheat price level over the world wheat price level, or indeed of the latter also, the Act would seem to hold out little promise. A careful reading of the Agricultural Marketing Act does not dis-

close provisions that are to be reasonably interpreted as formulated with the definitive objective of a differential enhancement of the American wheat price level beyond that otherwise attainable behind the tariff wall. We are unable to infer that the marketing of American wheat under the new law will make any sensible influence on the *world* wheat price level in the near future. Nor do we feel that the relation of the position of the *American* wheat price level to the world wheat price level is likely to be notably altered. In precisely this point lies the basic difference between the objectives of the Agricultural Marketing Act and of the equalization fee and the export debenture; the Act projects a reorganization and rationalization of the marketing of agricultural products, whereas the earlier plans aimed at a differential enhancement of the American wheat price level over the world wheat price level.

To those who are looking for conspicuous stabilization of wheat prices it seems to us the Act holds out very modest promise. Many who speak of stabilization of wheat price are thinking of an enhancement of wheat price; they imply stabilization upward, filling up the troughs and leaving the peaks, holding wheat prices steady near the top of the range. Stabilization, strictly construed, is quite different from enhancement. A competently managed centralized marketing of wheat would tend to steady domestic prices. There are two kinds of dealing that make for fluctuations in wheat prices—heavy dealing by professionals and heavy dealing by amateurs. The dealings of professional speculators are likely to be moderated under the Agricultural Marketing Act; but the dealings of the amateurs, the general public, may conceivably be exaggerated, in consequence of misinterpretation of the scope of governmental policy. Stabilization may be expected to improve prices incidentally, varying from type to type, from region to region, and from year to year. It seems likely that control of the marketing flow of member wheat and appropriate purchase of non-member wheat would tend to moderate the otherwise downward price movement following the harvest—not, however, with a demonstrable net gain to producers. But we are unable to feel that stabilization of wheat prices, strictly construed, is an outstanding objective of the operation or that the net increment reasonably to be attributed to stabilization of price movement will be measurable.

The Agricultural Marketing Act is not an instrument for the delivery of promised solatium. It is instead a forward-looking plan of reconstruction and rationalization of the marketing of agricultural products. The wheat growers in the co-operative associations will come to realize that they are running their own affairs, under guidance. They will come to understand the problems of the distribution of wheat, what is attainable through appropriate marketing tactics, and the relations of prices and price movements to commodity values at home and abroad. In short, wheat growers will learn their own business as they do not now understand it; they will correctly appraise the gains acruing to them. This means a veritable psychological revolution. Wheat growers now regard themselves as an exploited class; when they have become merged into representative co-operative associations, an objective revision of the status of wheat growing will follow. A passive or negative attitude will be transformed into a positive attitude, to the immeasurable gain of the group.

When wheat growers have had enlarged and extended experience in the handling of their marketing operations, they will become more receptive to guidance in matters of farm management. In particular, improvement in wheat culture, the raising of the weighted milling value of the crop through curtailment of substandard wheat and expansion of representative wheat, will become a growing development. Up to the present, for most wheat growers the advices of experts in the national and state Departments of Agriculture and in the extension services sound far-fetched and academic. When conjoined with their own managerial experiences, we believe expert advice will become more effective. Also, the study of production costs and measures for lowering the costs per acre and thus increasing net return per acre will be stimulated and perfected when wheat growers possess an adequate understanding of the limiting factors in the marketing of the wheat crop.

We indicated above how difficult would be the effective adjustment of production to demand. But however difficult the adjustment, it will certainly be less difficult when wheat growers are active in the management of their marketing affairs in the broad sense. At present, expansion or contraction of wheat acreage is a piece of strictly individual tactics in cut-throat competition; under circumstances entirely devoid of class solidarity, one grower attempts to gain at the expense of another. Not only that, but the need for adjustment of production to demand, of whatever extent and import, is not understood. It cannot be brought home as an adaptation essential to the commercial interest of the class. When wheat growers realize, through operations conducted under their own auspices, why certain wheats cannot readily be sold and why certain surpluses have untoward effects on price, influential motives for adjustment of acreage will become disseminated in all wheat-growing regions. When thus appreciated, they will tend to become effective.

We regard the policy incorporated in the Agricultural Marketing Act as embodying developments within the group of wheat growers and the reorganization of the marketing of wheat upon a long-term and comprehensive basis. Effective administration of the Act will enable wheat growers to make use of the advantages inherent in their business and evade certain disadvantages at least currently inherent in it. But the Agricultural Marketing Act cannot enable a Farm Board by external devices to put into wheat growing something that is not internal to it. It would be idle to prejudge the initial or subsequent accomplishments; it would be a waste of computation to forecast net increment per bushel or per acre. We look for substantial improvements to accrue. In a sense at once ideal and real, the projected reorganization and rationalization of the marketing of agricultural products is an experiment. It is an experiment that has wider relations than the direct interest of the agricultural class. The outcome may reasonably be expected to exert significant influence upon the character and direction of the current revolution in agriculture.

This study is the work of A. E. Taylor with the aid of criticisms and suggestions from J. S. Davis, Holbrook Working, and M. K. Bennett.

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WHEAT STUDIES

OF THE

FOOD RESEARCH INSTITUTE

VOL. V, NO. 10 SEPTEMBER 1929

SURVEY OF THE WHEAT SITUATION

APRIL TO JULY, 1929

WORLD wheat prices declined in April and May 1929, but rose precipitously in June and July as the new-crop outlook in North America, especially Canada, turned remarkably unfavorable. The movement of wheat in international trade was somewhat restricted, but net exports for the crop year 1928–29 nevertheless reached a record figure, about 935 million bushels. Extraordinarily heavy stocks of wheat in exporting countries continued to characterize the crop year 1928–29, which closed with by far the largest outward carryover of post-war years. The new crop year thus opens with this huge accumulation of stocks, but also with a Northern Hemisphere crop (ex-Russia, China, and Asia Minor) among the smallest in recent years. Canada has a notably short crop and the United States a rather small one; but Europe may harvest one of the largest crops of recent years, especially in the importing countries.

With the Southern Hemisphere crops not yet made, the outlook for trade and prices remains obscure. The international statistical position in 1929–30 will almost certainly prove tighter than those of 1923–24 and 1928–29; but in the absence of extreme crop damage in the Southern Hemisphere it will probably prove less tight than those of 1924–25 and 1925–26. The volume of international trade will prove considerably smaller than in 1928–29, but can hardly be foreseen within a narrower range than 750–850 million bushels. In so far as the international statistical position may be held to dominate prices, the level of international cash wheat prices in the ensuing six months seems likely to range well above the levels of 1923–24 and 1928–29, but below the levels of 1924–25 and 1925–26 unless severe crop damage occurs in the Southern Hemisphere. The resemblances now apparent between the opening weeks of the crop years 1924–25 and 1929–30 are no less striking than the differences.

STANFORD UNIVERSITY, CALIFORNIA

September 1929

WHEAT STUDIES

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FOOD RESEARCH INSTITUTE

The central feature of the series is a periodic analysis of the world wheat situation, with special reference to the outlook for supplies, requirements, trade, and prices. Each volume includes a comprehensive review of the preceding crop year, and three surveys of current developments at intervals of about four months. These issues contain a careful selection of relevant statistical material, presented in detail in appendix tables for reference purposes, and in summary form in text tables and charts.

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Entered as second-class matter February 11, 1925, at the post-office at Palo Alto, Stanford University Branch, California, under the Act of August 24, 1912.
Published by Stanford University for the Food Research Institute.

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FOOD RESEARCH INSTITUTE

STANFORD UNIVERSITY, CALIFORNIA

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The Food Research Institute was established at Stanford University in 1921 jointly by the Carnegie Corporation of New York and the Trustees of Leland Stanford Junior University, for research in the production, distribution, and consumption of food.

SURVEY OF THE WHEAT SITUATION

APRIL TO JULY, 1929

The closing four months of the crop year 1928–29 were noteworthy for a spectacular change for the worse in the outlook for the crops of 1930 in North America. The most striking results of this change were wide fluctuations in wheat prices, markedly in contrast with movements in the first two-thirds of the year; and a rather sharp reduction in the flow of wheat to export. The reversal in crop prospects tended to build up the outward carryover in exporting countries to a level even higher than had been anticipated. The crop year 1928–29 therefore closed with outward carryovers in exporting countries much the largest in recent years, with the greatest accumulations in the United States and Canada. The level of stocks in European importing countries was apparently one of the highest since the war.

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In April and May 1929 the outlook was roughly for a large but not a record crop in North America, and for a moderate one in Europe. During June and July, however, winter wheat in the United States and spring wheat in Canada and the United States suffered greatly from unfavorable weather conditions. In the United States, a total wheat crop of around 875 million bushels was expected as of June 1; but the standing official estimate as of August 1 is only 774 million. In Canada, the condition of wheat as of about June 1 was 100 per cent; as of August 1 it was only 66 per cent. This reduction of 34 per cent is the most extreme one recorded in post-war years; it compares with a reduction of 19 per cent in 1924, when Canada subsequently harvested her shortest post-war crop. In Europe, however, crop prospects improved rather than deteriorated.

Wheat prices in the leading markets of the world declined during April and May under the pressure of heavy stocks in exporting countries and an improving crop outlook in the Northern Hemisphere, a movement unprecedented in these months since 1910. At the end of May international wheat prices reached the lowest point in post-war years. But subsequent deterioration of North American crops more than offset the earlier decline. Prices rose with extreme rapidity from mid-June to mid-July. The maximum advance during June–July was recorded at Winnipeg, where the July future rose over 70 cents per bushel; it was in Canada that the crop outlook turned most unfavorable. In Buenos Aires the advance was only 35 cents, and less than this in some European countries. The rapid rise in prices sharply curtailed the movement of wheat in international trade, particularly Canadian exports; but it came too late to prevent the total movement for the year from reaching a new record. Preliminary data suggest that net exports in 1928–29 approximated 935 million bushels, not far below our May estimate of 950 million. At this figure, net exports were some 10 per cent larger than in any other year.

The outlook for crops, trade, and prices in 1929–30 remains obscure in its details, for the size and distribution of Northern Hemisphere crops is not yet certain, and Southern Hemisphere crops remain to be made. Preliminary data suggest, however, that the Northern Hemisphere crop, ex-Russia, approximates 2,900 million bushels, one of the smallest in recent years. It is larger than the very short crop of 1924, but some 450 million bushels below the huge crop of 1928, if allowance is made for underestimates of the 1928 crop in Canada and perhaps the United States. The crop of 1929 is relatively the shortest in North America, especially Canada; the European

importing countries and the northern African countries have large crops. It is too early to anticipate the outcome of the important Southern Hemisphere crops; these have not promised well on account of drought, but favorable weather might still reverse the outlook. Already it is clear that much less wheat will move in international trade in 1929–30 than in 1928–29, for exporters have less to export and importers require less.

If crops alone determined the international statistical position, that of 1929–30 must turn out to be a very tight one. But its tightness is much mitigated by the extraordinarily heavy inward carryovers in many important countries. The position will clearly prove tighter than in 1928–29 or 1923–24. It may or may not prove as tight as those of 1924–25 and 1925–26; the outcome of the Argentine and Australian crops will in great part determine this. The level and course of prices in the ensuing six months will be affected by crop developments in these countries; as usual at this season, there is little reason to suppose that the level of prices in the first half of August 1929 must prove to be the level prevailing in later months. Prices now stand above the level of 1928–29, and may reasonably be expected to remain above it. But how far above is another matter. The transition from the crop year 1928–29 to that of 1929–30 is commonly likened to the transition from 1923–24 to 1924–25. In this connection it is worth while to point out that the great increase of prices from September 1924 to January 1925 was due to a set of circumstances far different from any that may reasonably be anticipated for 1929–30.

I. NEW CROP DEVELOPMENTS

Crop developments during April–July 1929 were in many respects the antithesis of developments in the same months of 1928. In April 1928 the general outlook was for a world crop below average in size; but favorable spring and summer weather led to a record crop. This year the outlook in April was for a large though not a record crop; but the result, so far as it can be envisaged at present, is a rather small one. Spring wheat in Canada and the United States suffered extraordinary damage; winter wheat in the United States yielded much less well than seemed probable earlier. Continued drought in eastern Australia and in Argentina was unfavorable. Europe, however, experienced favorable weather in the later months of the period. The deterioration of wheat in North America during June and July led to a spectacular advance in international wheat prices, and profoundly affected the course of international trade and the outward carryover.

India and North Africa

The official estimate of the Indian crop now stands at 318 million bushels, about 9 million bushels larger than the preliminary estimate issued in April. The crop is thus about 24 million bushels larger than the poor one of 1928; but it ranks as the third smallest harvested since the war. The area sown was slightly larger than in any postwar year except 1928, but scanty winter rains and damage by cold weather resulted in relatively low yields per acre. A crop of 318 million bushels seems scarcely large enough to permit net exports during 1929–30, especially because it follows the shorter crop of 1928. Much depends, however, upon the level of international wheat prices and the progress of the crop to be harvested in March–May 1930.

The wheat crops of northern Africa developed favorably. The area sown, 8,168 thousand acres, was slightly the largest on record, exceeding that of 1928 by 164 thousand acres, and rainfall was ample. Standing estimates for Algeria, Morocco, and Tunis total 81.3 million bushels, a crop nearly 20 per cent larger than any previously obtained in these dependencies. The official estimate for Egypt has not yet appeared; but condition figures and trade reports suggest a distinctly large crop in this country as well. All told, northern Africa now appears to have secured a record outturn, around 40 million bushels larger than that of 1924, and some 20 million larger than that of 1928.

The United States

Winter wheat in the United States emerged from the winter under conditions favorable to fairly large production in 1929. The official estimate of condition as of April 1 was 82.7 per cent, as compared with a ten-year average of 80.9 per cent. Despite a severe winter which had created apprehension of an exceptional amount of winterkilling, abandonment of acreage proved unusually small, only 6.4 per cent according to official data as of May 1, as compared with a ten-year average of 10.5 per cent and the high figure of 25.1 per cent abandoned in 1928. As of May 1, the area remaining for harvest was 40,467 thousand acres, a figure reduced to 39,886 thousand as of July 1. This area was the largest on record except 1915 and the four post-war years 1919–22; it exceeds the area harvested in 1928 by over 3½ million acres. The increase in area to be harvested was due to the smaller winterkilling, not to enlargement of the area sown, which was over 4 million acres smaller in 1928–29 than in 1927–28. Private forecasts of production (four estimators) as of April 1 averaged 575 million bushels, a good crop but not a distinctly large one.

Weather conditions during April and May were on the whole favorable, but in June and July deterioration occurred. Official and certain private forecasts and estimates of winter-wheat production over the period under review were as follows, in million bushels:[1]

Estimator	Apr. 1	May 1	June 1	July 1	Aug. 1
Cromwell ..	590	599	615	594	567
Donovan ...	565	620	625	590	545
Murray	580	617	631	601	553
Snow	563	608	649	612	561
Average ..	575	611	630	599	557
Official	...	595	622	582	568

As the figures show, crop experts agreed that prospects improved considerably during April; forecasts as of May 1 averaged 611 million as against 575 million a month before. Improvement was centered principally in the states producing hard winter wheat—Kansas, Nebraska, Oklahoma, and Texas. In parts of these states generous rains relieved danger of drought. There was rather too much rain east of the Mississippi, though deterioration was slight or negligible; and in Washington dry weather turned prospects unfavorable. Cool and wet weather prevailed in May, leading to a further increase to 630 million bushels in the average of private forecasts as of June 1; and the official forecast was 622 million. According to the official data, the rains again improved prospects principally in Nebraska, Kansas, Oklahoma, and Texas, enough more than to offset deterioration in Illinois and Missouri, where rain was excessive, and in Colorado.[2]

The general outlook turned less favorable during June. As of July 1, the official forecast of production was reduced 40 million bushels, the average of private forecasts by 31 million. According to official data, the deterioration was most marked in Kansas, Oklahoma, and Nebraska, though it was also significant in Ohio, Illinois, Missouri, and Colorado; rains in the Pacific Northwest brought notable improvement. Excessive rains hampering harvest, and a hot wave which promoted premature ripening, appear to have been the principal causes of damage in the hard winter-wheat belt.

Further damage occurred in July, mostly in the first half of the month from excessive rain in some regions, excessive heat in others; threshing returns proved disappointing. Private estimates averaged only 557 million bushels as of August 1, a reduction of 42 million bushels from the July figure. The official estimate, 568 million bushels as compared with 582 million as of July 1, tended to confirm the unfavorable developments, but not fully. Estimates for practically all of the important states

[1] Data from *Daily Market Record* and official sources. Private forecasts appear about the first of each month, the official about the tenth. The fact that the official forecast as of May 1 fell so far below most private forecasts may have been due in part to a change in the official "par yield" for the month. See explanation by B. W. Snow, in *Modern Miller*, May 11, 1929, p. 33.

[2] It is interesting to observe, as a commentary on the uncertainty surrounding crop prospects in any large country, that Murray's reports suggested deterioration rather than improvement in Oklahoma and Texas, and improvement rather than deterioration in Colorado, and also in Washington.

producing hard and soft red winter wheat were slightly reduced, but there was some improvement in the Pacific Northwest.

The changing prospects for winter wheat during April–July, though striking enough, cannot be regarded as unusual. The August official estimate was 27 million below the May forecast. Last year the August estimate was 93 million bushels above the May forecast; in 1926 it was 77 million higher; in 1921 it was 85 million lower. One may also find more extreme instances of changes between June and August forecasts in the past eight years. This year there was a reduction of 54 million bushels in official forecasts between these two months; but in 1922 there was a reduction of 65 million, in 1924 an increase of 80 million, in 1926 an increase of 83 million, and in 1928 an increase of 67 million.

Changes in the outlook for the American spring-wheat crop are difficult to describe. As of March 1, farmers had expressed intentions to plant some 21.5 million acres, an area well above the average of recent years and only slightly below the area harvested in 1928. The first official estimate as of July 1 was for 20.9 million acres, again a fairly high figure. By comparison with the harvested acreages of 1928, the bread wheat area sown in 1929 was 680 thousand acres larger, the durum area 1,354 thousand smaller. Condition as of June 1 was 84.8 per cent (official data), somewhat below the ten-year average of 88.4 per cent. The supply of subsoil moisture was then regarded as satisfactory except perhaps in western North Dakota, eastern Montana, and the Pacific Northwest.

The outstanding feature of June and July weather was its extreme variability from locality to locality, with respect to both rainfall and temperature. Private forecasts of production[1] averaged 258 million bushels as of June 1, and 249 million bushels as of July 1; three experts suggested deterioration, one suggested slight improvement. The official forecast was 251 million, with indication of yield apparently somewhat, but not markedly, below the ten-year average of 12.6 bushels per acre for all spring wheat. In July, deterioration was much more apparent than in June. Widespread rains were needed but did not come; there were ample showers in some localities and not in others; some localities suffered from extreme heat, others from cold, others from high winds. Private forecasts as of August 1 averaged only 202 million bushels, a reduction of 47 million in the course of the month. The official forecast was 206 million bushels, 45 million below the July figure. The contrast with 1928 is striking; July official forecasts were about the same in both years, but in 1928 the August forecast was 57 million bushels above the July.

Thus, in the course of two months, the earlier outlook for a distinctly large crop of winter wheat and a fair crop of spring was altered sharply, and only a fair crop of winter wheat and a poor one of spring were secured. The total United States wheat crop, now officially estimated as 774 million bushels, is smaller than any in the past decade except that of 1925; but it exceeds that crop by nearly 100 million bushels, and hence is not so markedly a short one. The crops of 1921 and 1923 were but little larger; but the excellent crop of 1928 exceeded it by over 125 million bushels. These comparisons rest upon official estimates for the earlier years; and since the crops of 1923, 1925, and 1928 may have been officially underestimated, the crop of 1929 may compare even less favorably with them if the standing official estimate as of August 1 remains unchanged in later revisions. Trade comments suggest that in so far as the standing official estimate may prove inaccurate, it places outturns in the hard spring-wheat belt and in the Pacific Northwest somewhat too low.

In its distribution by classes,[2] the crop of 1929 is noteworthy for the short crops of hard red spring and durum wheats; these, at approximately 126 and 54 million bushels respectively, rank with the poorest in

[1] Private and official forecasts were as follows, in million bushels:

Estimator	June 1	July 1	Aug. 1
Cromwell	256	244	211
Donovan	260	240	195
Murray	251	247	194
Snow	263	266	209
Average	258	249	202
Official	...	251	206

[2] See *Foreign News on Wheat*, August 15, 1929, table on p. 5.

the past decade. They are much the same in size as the crops of 1921, 1923, and 1926, far smaller than the excellent crops of 1927 and 1928. The crop of hard red winter wheat, approximately 330 million bushels, is a good one; only those of 1924, 1926, and 1928 were larger in the past nine years. The outturn of soft red winter, some 189 million bushels, is around 50 million bushels larger than that of 1928, but is still only a fair one; considerably larger crops were harvested in 1920–23 and in 1926. The crop of white wheat, some 75 million bushels, is only a little below average in size. So far as domestic requirements are concerned, there can be a shortage only in hard red spring wheat; and this is mitigated by the size of the outward carryover. Preliminary indications point to fairly good quality, especially with respect to the protein content of hard winter wheat.

Canada

So drastic a reversal in the wheat-crop outlook in Canada as occurred this year has not been witnessed in the past decade, even in 1924. With a single exception, the several principal factors making for heavy production were fairly favorable in the earlier months. Seeding was a little late, but by no means so late as in 1927–28. Germination was satisfactory. Early growth was rather slow on account of cool, dry weather, but served to give the plant good roots. Subsoil moisture, however, was decidedly scanty. It is impossible to sum up accurately what may be called the consensus of opinion regarding probable outturns at any time. Nevertheless one may say with moderate assurance that at the end of May there seemed to most observers no good reason to anticipate, under normal weather conditions, either so short a crop as that of 1924 or so huge a one as that of 1928. At the time expectations were in general hardly more definite than this.

The fact that subsoil moisture was deficient was widely regarded as an unfavorable feature, but hardly so unfavorable as was indicated by a careful statistical analysis published by the United States Department of Agriculture on June 15.[1] This analysis, based upon temperature and rainfall data in Saskatchewan during the September–April period from 1905 to 1928, led to the inference that weather conditions during September–April, without regard to the growing season, could reasonably be expected to result in a yield per acre of only 15 or 16 bushels in Canada, and a crop of only 360–400 million bushels. It is doubtful if most observers have been accustomed to attach such importance to September–April weather as this analysis attributes to it; and there seems to be no evidence that, late in May or early in June, the general expectation of probable outturn in Canada was crystallized about so narrow a range as 360–400 million bushels. So far as one can judge by comments in trade journals, a considerably larger crop than 400 million bushels was regarded as probable if June–August weather proved distinctly favorable, and one considerably smaller than 360 million bushels if distinctly unfavorable weather supervened. The deficiency in subsoil moisture seems to have been regarded by most observers more as a potential than as an actual cause of damage.

Condition as of May 31 was officially placed at 100 per cent of the average yield per acre of the preceding ten years. Comparisons of this figure with those issued in earlier years are of limited significance, for the ten-year average is different in each year; it was higher this year than it was a year ago because of the exceptionally high yield per acre secured in 1928. Hence the fact that the condition estimate of May 31, 1929, was the same as that of May 31, 1928, does not lead to the inference that the same yield per acre seemed probable in both years; rather it signified that, for the date, the outlook was rather better this year.

Condition estimates may be employed, however, to illustrate the comparatively extreme deterioration in crop prospects which occurred in the course of June and July. Comparisons with 1924 and 1928 are illuminating. The figures below show condition of spring wheat in all Canada as of the dates indicated:[2]

[1] See *Foreign News on Wheat,* June 15, 1929, pp. 12–16.

[2] Official data from *Monthly Bulletin of Agricultural Statistics* and press releases.

	Condition in per cent on		
	May 31	June 31	July 31
1924	96	92	77
1928	100	103	107
1929	100	88	66

The decline of 12 points in June was the largest June decline on record in post-war years; since 1919 the largest June declines were 5 points in 1922 and 4 points in 1924. It appears to have resulted chiefly from deficient rainfall added to subsoil moisture already in short supply, though on different days there were high winds, or heat, or unseasonably cold weather. Deterioration became evident in the second half of the month, as is evidenced by condition estimates for the Prairie Provinces issued by the Canadian Pool.[1] As in the United States spring-wheat belt, condition at the end of June varied greatly from locality to locality. But in general a continuing deficiency of rainfall, with cumulating unfavorable effect on the growth of wheat, was the fundamental cause of deterioration.

The same cause was dominant in July, and in addition there were many days of extreme heat and of high winds. For the month as a whole, the official condition figure fell 22 points to 66 per cent, a considerably greater decline than occurred even in 1924 and the lowest on record for the date in the past decade. The greater part of the deterioration occurred in the first half of the month, especially in the first week. Between June 29 and July 11, according to the Pool's data, condition in Alberta declined 22.2 points, in Saskatchewan 13.5 points, in Manitoba 14.2 points. By mid-July it was apparent that a large crop was hardly possible, for many fields were damaged beyond hope of recuperation even under the most favorable weather conditions. There was further deterioration in the latter third of July, but not so marked as in the preceding four weeks. Wheat sown on fallow and new breaking withstood the drought much better than wheat sown on stubble. Much of the wheat headed on short straw, and the crop will contain many weed seeds because the weeds withstood the drought better than the wheat. Naturally, precipitation and rainfall were not uniform in their effect from locality to locality; and if in some regions wheat at the end of July seemed clearly a complete failure, in others the outlook was favorable.

The spotted conditions gave rise to wide variations in forecasts of total production as of August 1: some observers doubted if more than 175 million bushels would be produced in Canada, while others regarded as much as 350 million as possible. American experts,[2] however, presented forecasts as of August 1 which ranged only from 240 to 252 million bushels for the three Prairie Provinces. The official Canadian condition figure was interpreted to indicate a crop in the Prairie Provinces lying somewhere between 210 and 280 million, with around 25 million more for Canada as a whole. No official forecast of production will appear until September 10. Weather conditions during the month of August have not been generally favorable, in that widespread rains, which would have been beneficial in filling heads, have not occurred. Further damage is possible if there are heavy frosts or if the harvest is wet; but these factors would affect quality rather than quantity. Any forecast of production must be tentative at the date of writing, if only because conditions are so highly variable in different localities. In the light of current information, a crop of some 260 million bushels in Canada as a whole represents a reasonable guess at the middle of the probable range; but it may well prove considerably more or less than this.

If the Canadian crop reaches only 260 million bushels, it will be smaller than any crop obtained from an area exceeding 20 million acres—that is, the crops of 1921–28. The crop of 1924, the smallest during this period, was officially placed at 262 million bushels, but was apparently underestimated; the largest crop, 534 million bushels, was that of 1928, which also appears to have been underestimated.[3] Since this

[1] These figures, expressed in terms of percentage of a "full yield," not a ten-year average yield, are as follows:

Date	Manitoba	Saskatchewan	Alberta
June 1	93.7	95.1	96.5
June 15	91.2	91.9	93.6
June 29	84.2	82.5	76.2
July 11	70.0	69.0	54.0
July 18	58.0	60.0	50.0
July 25	60.0	56.5	44.0

[2] Messrs. Cromwell, Donovan, and Murray.

[3] See Appendix Table XI, and below, p. 439.

year's crop was obtained from the largest sown area on record, so small an outturn as 260 million bushels would represent the smallest yield per acre in recent years.[1]

Europe, Excluding Russia

Sharply in contrast with the situation in North America, European (ex-Russian) wheat-crop prospects improved during April–July. The spring was late and cold, and the severe winter, as well as frost in April, had occasioned much more than the normal amount of winterkilling in certain areas, notably parts of Roumania, Bulgaria, and Hungary; northern France, Belgium, and Holland; and northwestern Germany and the Baltic states. Hence the general outlook in April was not especially favorable, in spite of some increase in the area sown. Opportune rains and warmth greatly improved the outlook during May and June, though the period was rather dry and improvement was not uninterrupted.

Weather conditions during July were mostly favorable; toward the end of the month, however, a spell of extreme heat caused some premature ripening in the more northerly countries, especially Germany. The earlier crops—in the Danube countries, Spain, Italy, and France—were for the most part harvested in reasonably dry weather. To the date of writing (August 25) fragmentary reports suggest satisfactory August weather in Europe, neither notably favorable nor notably unfavorable. But the reports are too scattering and indefinite to yield a clear picture of more recent developments, and the experience in other years shows that weather conditions in the late growing and harvesting season may affect outturns considerably. Last year, for example, the outlook in mid-August was for smaller crops than were actually harvested.

The outcome is therefore hardly clear at the moment. The following figures show such standing official preliminary estimates of wheat production in 1929 as are available, in comparison with averages for 1924–28 and with outturns in 1924 and 1928. Data are in million bushels.

Country	Average 1924–28	Final 1924	Final 1928	Preliminary 1929
Hungary	74.9	51.6	99.2	70.6
Bulgaria	39.1	24.7	50.7	37.4
Roumania	99.7	70.4	115.5	91.9
Jugo-Slavia	73.5	57.8	103.3	96.9
Total	287.2	204.5	368.7	296.8
Spain	139.7	121.8	122.6	139.8
Italy	211.2	170.1	228.6	238.8
Netherlands	5.9	4.7	7.3	3.8
Belgium	14.9	13.0	18.0	16.0
Switzerland	3.8	3.1	4.3	5.8
Germany	113.0	89.2	141.6	125.0[a]
Greece	12.0	7.7	15.7	16.8
England, Wales	50.1	50.9	47.3	41.8
Austria	10.7	8.5	12.9	11.6[b]
Poland	50.2	32.5	59.2	64.7
Total	611.5	501.5	657.5	664.1

[a] Calculated on the basis of an official estimate of winter-wheat production, in which the outturn was placed at 110 million bushels as against 127 million in 1928.
[b] Winter wheat only.

On the basis of these figures and less specific advices, a few conclusions seem tenable. The crop in the four Danubian exporting countries is surely much smaller than the bumper crop of 1928, but much larger than the short crop of 1924; it is a little above the 1924–28 average, but may prove lower if trade opinion is justified in expecting downward revisions of some of the official estimates.

The crop of the importing countries of Europe is certainly much larger than the short crop of 1924. It may prove even larger than the excellent crop of 1928, though this is not certain in the absence of official estimates of the outturns in France, Czecho-Slovakia, Denmark, and Sweden. Trade reports suggest that all of these countries except France are harvesting smaller wheat crops than in 1928, though probably not much smaller in the aggregate.

The outturn in France is of major significance, but opinions vary widely. The United States Department of Agriculture anticipated as of August 15 a crop smaller than that of 1928, which was 281 million bushels. Trade estimates have run higher,

[1] It will be of interest to observe how far the yield per acre in Saskatchewan will prove to fall below the United States Department of Agriculture's estimate, based upon September–April weather conditions, of 15 bushels. Over the period 1905–28, the Department's calculated yield differed from the official estimate of yield by a maximum of 4.2 bushels per acre, in 1924.

even up to 400 million bushels. So far as we are able to evaluate the widely variant reports, a crop in the neighborhood of 320 million bushels more or less is in prospect.

If the French crop reaches or exceeds 320 million bushels, the European importing countries as a group are assured of a crop larger than that of 1928—the largest, indeed, in recent years, and much the same in size as the bumper post-war crop of 1925. Whether the net increase in the wheat crop of the importing countries of Europe will prove large enough to balance the decrease in the Danube countries is difficult to say.

The distribution of the European crop now appears to be approximately a normal one. Most countries have average crops or better. There are no conspicuously short crops among the larger producers, such as the Spanish crop of 1928; and there are no such conspicuously large crops as the 1928 outturn in the four Danube countries and Germany. The quality of early-harvested grain is reported to be good, though perhaps not so good as in 1928. The quality of later-harvested grain will depend upon the weather at harvest. Heavy rains could still assume some importance by intensifying the need of European millers for sound dry wheat in their mill mix, as was the case in 1924; but it is rather late in the season for such rains to cause marked damage.

Other Northern Hemisphere Countries

Crop developments in various other countries of the Northern Hemisphere are more difficult to picture. To judge by standing official estimates, the season must have been favorable in Japan and Chosen and in Mexico, where outturns are reported larger than in 1928 and above the 1923–27 average. The crop in Syria and Lebanon is estimated much above the short crop of 1928; if one may infer from this that Asia Minor as a whole has a larger crop, this area will need to import considerably less wheat in 1929–30 than in 1928–29. The Chinese crop apparently turned out rather poorly, though comparisons rest on a most uncertain basis in the absence of estimates of acreage, condition, or yield. In the Yangtze Valley, the wheat crop is said to be smaller and of poorer quality than the good crop of 1928; the more northerly provinces of Shantung and Chihli appear to have experienced a second crop failure; in North Manchuria, however, the outturn of all cereals, and thus perhaps of wheat, is estimated to be larger than in 1928.

In Russia certain aspects of the situation are clear. As in western Europe, the spring was late and cold. Official advices indicate an increase of 3 per cent in the area sown to all grain, both winter and spring, and of nearly 6 per cent in the acreage of spring wheat. Winterkilling was said to be about normal, despite the severe winter. Condition of all grains in mid-July was mostly average or above, and average crops were anticipated. Stress was laid upon the outlook for much better outturns in the southwestern regions this year than in 1928, and it was thought that this change in distribution would facilitate collection of grain, minimizing some of the difficulties encountered during 1928–29. Exports in 1929–30, however, were thought to be improbable on account of the necessity of building up stocks in the consuming regions. At the moment there seems little likelihood that Russia should experience a crop failure such as that of 1924; on the other hand, there is no evidence tending to suggest that the crop is an exceptionally large one.

The Southern Hemisphere

Throughout the period under review, the outlook for Southern Hemisphere crops has remained unfavorable on account of widespread and long-continued drought. The area sown in Australia is said at least to have maintained the high level of 1928; but trade reports from Argentina have reiterated that a decrease of 10 to 20 per cent was probable there. An official report issued early in August, however, suggested that the decline was confined to the province of Cordoba, while some increase had occurred in Santa Fé. It was in Cordoba that rainfall was most markedly deficient. In Australia the driest weather was experienced in the eastern states, Victoria and New South Wales. At this date it is unwise to assume either that the area sown in Argentina has been drastically reduced, or

that yield per acre in either country must prove small. Under favorable conditions wheat can be sown in August, at least in Argentina. The wheat plant is in its earlier stages of growth in both countries, and ample rainfall in September–November could result in high yields; rains in Australia in late October 1928, for example, resulted in a large crop when a distinctly small one had been anticipated earlier. On the other hand, the crops in both countries may encounter further drought, and, in Argentina, frost or rust. Changing crop prospects in the Southern Hemisphere may confidently be expected to exert a strong influence on prices and trade in the fall and winter months, perhaps all the more so because European importers have been and continue to be able to secure exceptionally large supplies from Argentina. At the moment the chances are adverse to heavy production in either Australia or Argentina, though rainfall in early August has somewhat improved the outlook; but prospects may become much worse or much better.

II. VISIBLE SUPPLIES AND OUTWARD CARRYOVERS

Enormous quantities of wheat in commercial channels, especially in North America, have characterized the crop year 1928–29 throughout its course, as markedly in April–July as in earlier months. There can be little question that this situation, itself the result of bumper crops in exporting countries, persistently acted as a drag upon upward movements of prices, even during the precipitous advance of June–July. At no time during the crop year have importers been forced to indulge in precipitous and panicky buying such as occurred in the course of 1924–25 and 1925–26.

At the close of the year, outward carryovers were of record size in the United States and Canada—in Canada, considerably larger than would have occurred in the absence of the severe damage incurred by the growing wheat crop. Argentina and Australia also carried over exceptional quantities of wheat, but in these countries the supplies were not so strikingly large as in North America. The evidence suggests that year-end stocks were also above average in size in many European countries as well, notably in the Danube countries; only in Great Britain, and perhaps Spain and Portugal, were they presumably below average. All told, it seems certain that the world carryover out of 1928–29 was by far the largest in post-war years, even with allowance for relatively small stocks in India and perhaps Russia. The presence of this huge carryover constitutes one of the outstanding differences between the opening of the crop year 1929–30 and that of 1924–25, which in some other ways are similar.

Visible Supplies

Chart 1 (p. 436) summarizes data on visible supplies, chiefly in North America. In the United States, visibles declined more rapidly in April and May than they did in 1928, partly because declining prices resulted in smaller marketings by farmers,[1] partly because exports were larger this year, especially in May. Rising prices in June led to increased marketings by farmers, but the export movement was fairly small; hence visibles declined only slightly. The seasonal upturn in late June and July began at about the usual time; the subsequent increase was greater than in any of the past five years. Rising prices stimulated the movement from farms, but tended to restrain purchases by importers. As of July 27, Bradstreet's visible stood at 125 million bushels, somewhat further above the comparable figure for 1927–28 than it had been at any time during 1928–29. Visibles rose further by some 20 million bushels in the week ending August 3 and again by 20 million in the week ending August 10; and this increase, added to the existing enormous commercial stocks, was a price-depressing factor of some importance.[2] At

[1] See Appendix Tables II and III, which show monthly and weekly receipts at primary markets in the United States.

[2] These heavy marketings by farmers evoked on August 3 the following statement from the newly organized Federal Farm Board: "The Federal Farm Board has made no statement or forecast whatsoever concerning a proper price for wheat for this market year nor does it propose to do so, but under conditions which exist this season when all reports agree on a substantial reduction in world supply as compared with last year, it seems unfortunate to crowd

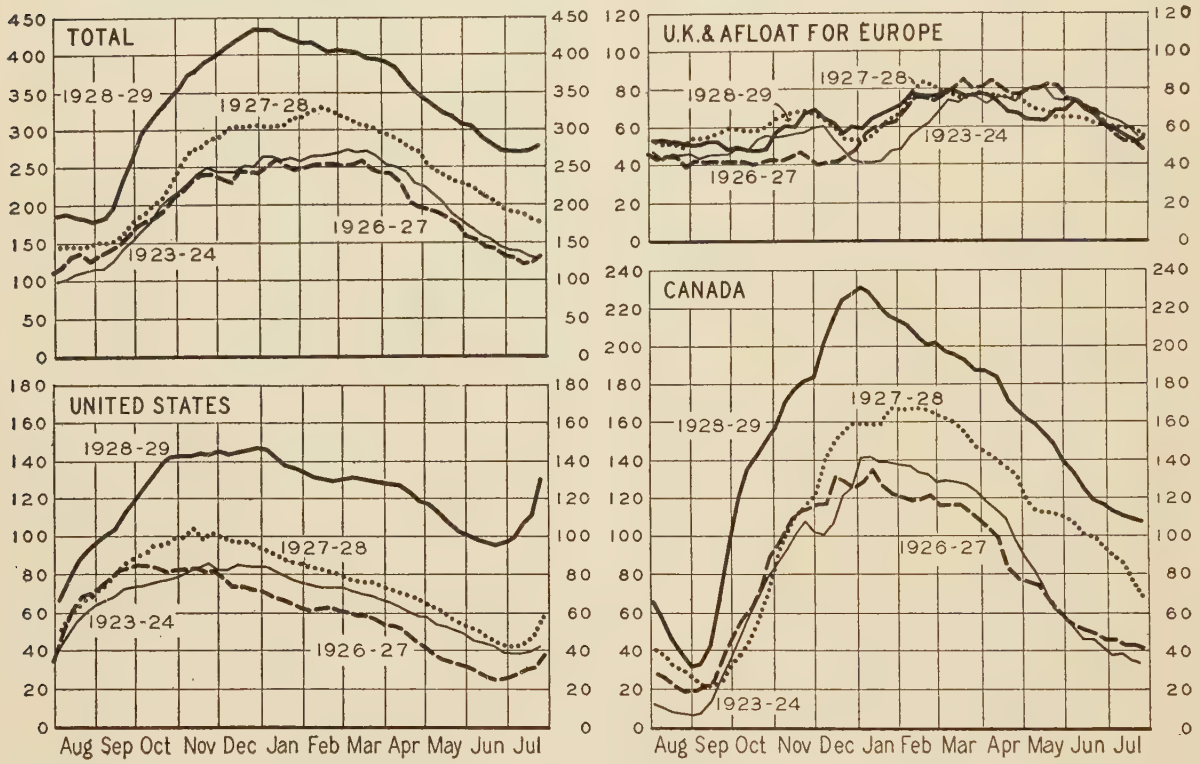
the end of July, though practically all terminal markets held more wheat than in 1928, the concentration of holdings was most noteworthy in Minneapolis, Kansas City, Duluth, and Chicago. Visibles in these four markets totaled 80.8 million bushels as against 32.3 million the year before, an increase which accounts for 48.5 million bushels out of the total increase (Chicago Board of Trade data) of 66.8 million.

Canadian visible supplies declined somewhat more rapidly during April–June 1929 than they did in the same months of 1928; the export movement was a trifle larger this year, especially in June, while receipts at terminal markets, notably Vancouver, were smaller.[1] But in July receipts grew larger and exports much smaller as compared with July 1928, as Canadian prices rose precipitously under the influence of unfavorable crop developments; and the visible supply showed a decidedly smaller decline. At the end of July these stocks reached 107 million bushels, a record figure for this time of year, and 38 million above that of 1928. Of this increase, the greater proportion occurred in stocks in terminal elevators at Fort William and Port Arthur, and in lake and Atlantic ports of the United States.

Visibles afloat for Europe and in ports of the United Kingdom fell to relatively low levels in late April and May, as overseas shipments declined sharply;[2] they rose with increasing shipments in late May and early June, and fell again — much more abruptly than in 1928 because shipments declined more rapidly—in later June and July. At the end of July stocks afloat for

CHART 1.—VISIBLE WHEAT SUPPLIES IN THE UNITED STATES, CANADA, AND UNITED KINGDOM PORTS AND AFLOAT TO EUROPE, WEEKLY, 1923–24, AND FROM AUGUST 1926*

(*Million bushels*)



* Data from *Grain World, Northwestern Miller,* and *Canadian Grain Statistics.*

wheat onto the market faster than existing facilities can handle it, resulting in cash prices which are much lower than contract prices for future delivery."

[1] See Appendix Tables II and III.

[2] See below, p. 448.

Europe were 42.5 million bushels, about the average of the preceding five years, but somewhat below the figures for 1927 and 1928. Port stocks in the United Kingdom, 6.0 million bushels, were below the five-year average, and 4.4 million smaller than those of 1928.

The total visible changed in accordance with changes in its major component parts, declining rather more rapidly in April–June than it did in 1928, but rising rather than declining (chiefly on account of the rapid increase in the United States visible) in July. At the end of July the total reached 281 million bushels, an increase during the year of 100 million. A more elaborate statement of the world visible supply, including certain stocks in Argentina and Australia, gives a figure of 370 million bushels as of August 1.[1] This total by far exceeds any other as of the same date in post-war years; it surpasses the previous record figures of 1928 and 1924 by 143 and 178 million bushels respectively.

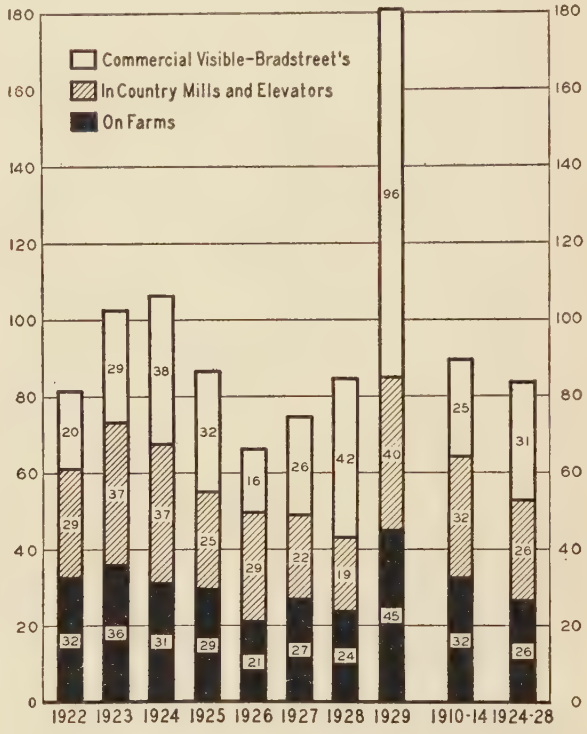
United States Stocks, June 30, 1929

The total outward carryover of wheat (including a little flour) in the United States, so far as it is measurable, proved by far the largest on record in recent years.[2] Three of the major components in the total —stocks on farms, stocks in country mills and elevators, and visibles in terminal elevators—are shown, with comparisons, in Chart 2. The sum of these three items was 180.6 million bushels, nearly 75 million more than the next highest figure shown on the chart, that of June 30, 1924; 70 million higher than the previous record for post-war years established in 1920;[3] and more than twice as large as that of 1928. All three components of the total were relatively high; but visible supplies of 96 million bushels were most strikingly so, being the largest in history by a wide margin. Stocks on farms, 45 million bushels,[4] were exceeded in 1920 and 1921; and stocks in country mills and elevators, 40 million bushels, were rather closely approached, though they were not exceeded, in 1920, 1923, and 1924.

Stocks held by city mills, the fourth component of the total carryover, were of unprecedented size for the five years in which estimates have been obtained. The data appear in Table 1 (p. 438). Excluding

Chart 2.—Wheat Stocks in the United States, July 1, 1922–29, with Comparisons*

(*Million bushels*)



* Official data except Bradstreet's visible, as tabulated in Appendix Table VIII. Country mill and elevator figures for 1926–29 are estimated on a new basis, and probably are not strictly comparable with figures for earlier years.

the first two items (mill stocks held in public terminal elevators and in country elevators) so as to avoid duplication in computing the total United States carryover, the carryover held by city mills was 81.5 million bushels, a quantity exceeding any of the past four years by from 18 to 39 million. These stocks were nearly 24 million bushels larger this year than last; the increase occurred in all items.

All told, therefore, the four principal items of the United States carryover totaled

[1] See Appendix Table VII.

[2] It was almost certainly by far the largest in history; but strictly comparable data are not available prior to June 1925.

[3] See Appendix Table VIII for data prior to 1922.

[4] An indeterminate proportion of farm stocks in the Southwest was probably of poor quality, being bin-burnt grain.

262 million bushels. So far as we are able to ascertain, this is by far the largest of any in the past seven years—nearly 100 million bushels larger than that of June 30, 1924, and fully 120 million larger than that of 1928. A precise analysis of the factors causing the carryover of 1928–29 to be built up to so extreme a height need not be undertaken here. Certainly the major part of the upbuilding did not occur in March–June; for reductions of the various components of the total between March 1 and June 30 were not much smaller than usual.[1] Practically throughout the year wheat prices in the United States were maintained at too high a level to permit exports consistent with the size of the large crop; exporters in competing exporting countries were willing and able or felt compelled to accept lower prices. The situation now seems traceable principally to the heavy crops of 1928 secured in Canada, Argentina, and Australia; to the prevailing relatively low level of world prices; to more ample storage facilities in this country; and to the fact that domestic demand plays a relatively stronger rôle in the United States than in competing exporting countries. But other factors, among them speculative activity, relative interest rates, international trade balances, and expectations that governmental influence would be brought to bear on wheat prices, were also operative.

Table 1.—United States Census Reports on Mill Stocks of Wheat and Flour, June 30, 1925–29

(*Million bushels*)

June 30	Wheat			Flour as wheat[b]	Grand total
	Country elevators	Public terminals	Private terminals[a]		
1925.....	2.16	3.44	26.72	15.73	48.04
1926.....	2.52	3.00	30.32	14.67	50.51
1927.....	2.56	3.88	46.15	16.76	69.35
1928.....	1.91	3.68	40.50	17.08	63.15
1929.....	3.52	8.32	63.51	17.98	93.33

[a] Includes wheat in transit and in mill elevators.
[b] Barrels of flour converted at 4.7 bushels per barrel.

The appearance of fairly definitive estimates of the outward carryover completes certain data needed to adjudge the accuracy of the 1928 official crop estimate, now standing at 902 million bushels.[2] The inward carryover was 142 million bushels, so that available supplies for 1928–29 totaled 1,044 million bushels. Official data on net exports (including shipments to possessions), seed requirements, and the outward carryover, together with our own estimate of wheat consumed for food, total 1,008 million bushels. A residual of only 40 million bushels is left to cover wheat fed to animals and wasted—a figure hardly to be regarded as sufficiently high, especially for a year of low wheat prices. It is impossible to adjudge the accuracy of the crop estimate with precision; for error may be present in our estimate of consumption, the carryover data do not include some invisible items, and it is as yet impossible to obtain securely founded notions of the quantities fed to animals and wasted annually. Nevertheless one may venture to assert that the crop of 1928 was certainly not overestimated, and was probably underestimated.

Canadian Carryover, July 31

The carryover of Canadian wheat in Canada was brought to an extremely high level, in some part by a reduction of net exports in July, a reduction itself due to rising prices caused by the extraordinarily poor progress of the growing wheat crop. The official estimate as of July 31 was 104 million bushels, some 39 million in excess of our forecast issued in late May, and 27 million above the next largest carryover on record, that of 1928. Each item in the total except stocks in transit was of record size for the period over which comparisons are possible.[3] Though most of the increase was in stocks held in elevators, even this huge figure does not state in full the carryover of Canadian wheat; for some 23 million bushels in addition were in store in lake and Atlantic ports of the United States, as

[1] The five-year average reduction occurring between March 1 and June 30, 1924–28, in combined farm stocks, country mill and elevator stocks, and visible supplies was 187 million bushels; this year it was 177 million. City mill stocks were reduced between March 31 and June 30, 1926–28, by some 29 million bushels, and this year the reduction was 26 million.

[2] See disposition statistics in Appendix Table XI.

[3] See Appendix Table VIII.

against 14 million in 1928 and an average of 3.6 million for the years 1924–27.

The appearance of the carryover estimate suggests fairly definitively, as is pointed out by the Dominion Bureau of Statistics, that the Canadian crop of 1928, now placed officially at the record figure of 534 million bushels, was appreciably underestimated. Available supplies (official crop estimate plus inward carryover) were apparently 612 million bushels; but net exports and the outward carryover, plus the quantities of wheat consumed domestically as food, feed, seed, and waste total 643 million bushels.[1] This suggests that the official estimate now standing of the crop of 1928 is roughly 25–35 million bushels too low.

Southern Hemisphere Stocks

In view of uncertainties surrounding Argentine crop estimates for 1927 and 1928, the problem of measuring the size of the outward carryover on August 1, 1929, has become even more difficult than in earlier years. The United States Department of Agriculture computed the Argentine exportable surplus as of July 1 at 80 million bushels, on the basis of a probable range reported by the American consul at Buenos Aires.[2] This implies an exportable surplus of some 65 million bushels as of August 1, since exports in July were about 15 million bushels. Broomhall on July 17 published an estimate of 68 million bushels for the Argentine "reserve"; but on July 24 he stated that his agent in Buenos Aires expected the "carryover" on August 1 to reach 96 million bushels; and on July 31 he placed the "reserve" at 88 million bushels. These figures seem to rest upon a direct estimate of stocks published in the *Times of Argentina* on July 22; the estimate included stocks in railway stations, in ports, and on farms. A similar estimate for June 30, 1928, proved to be a conservative one;[3] and the estimate for June 30, 1929, is regarded as conservative by its compilers. We tentatively employ as Argentine stocks on August 1, 1929, the rounded figure of 100 million bushels. This is considerably the largest of recent years.

If the Argentine carryover approximated 100 million bushels, even the standing official estimate (307 million bushels) of the crop of 1928 appears to be below the truth. The items of disposition total 409 million bushels, available supplies only 387 million.[4]

The Australian stocks position is likewise uncertain. The United States Department of Agriculture, employing for 1929 a figure obtained through the American consul at Melbourne, placed Australian stocks (apparently total) at 53 million bushels as of July 1, 3 million bushels less than a year before. This implies stocks on August 1, 1929, of roughly 45 million bushels compared with roughly 48 million a year before. Broomhall judged the exportable surplus as of August 1 to be some 24 or 25 million bushels, 4 or 5 million bushels larger than in 1928.

Our calculations, if based on the assumption that the 1928 crop was accurately estimated, lead to the conclusion that August 1 stocks in Australia approximated 43 million bushels, 3 million above those of 1928. This result is rather difficult to reconcile with the low prices prevailing in January–May 1929 and the unfavorable early crop prospects in Australia, both of which presumably tended to restrain exportation and to encourage upbuilding of stocks. Here also the evidence suggests that the crop of 1928 may have been underestimated, though presumably by only a small amount; and this is not clear in the absence of net export statistics for June and July.

If our analysis of the stocks position is approximately correct, it implies that the wheat crops of 1928 were appreciably underestimated in three of the four major exporting countries. All told, the underestimations may have reached as much as 75–100 million bushels. To allow for these quantities in evaluating the international

[1] See Appendix Table XI.

[2] See *Foreign News on Wheat*, July 15, 1929, p. 2.

[3] At least 80 million bushels of wheat must have remained in Argentina on August 1, 1928; for net exports in August–December 1928, before the advent of the new crop, were some 55 million, and something like 25 million bushels must have been used in these months for domestic consumption. But one could reasonably infer from the *Times of Argentina* estimate of stocks on June 30, 1928, that on August 1, 1928, stocks were hardly more than 70 million bushels.

[4] See Appendix Table XI.

statistical position during 1928–29 would show the actual position to have been considerably easier than it earlier appeared to be. The extensive underestimation of crops in some part explains why carryovers now seem to have proved larger than appeared probable in earlier months of the year.

European Stocks

Any evaluation of the carryover in European countries must rest partly upon assumptions, partly upon inferences drawn from production, trade, and price statistics, and partly upon unofficial statements. The evidence is in some respects contradictory; but the subject is of such considerable importance in view of the oncoming crop year of relatively short wheat crops that a tentative examination of it is desirable.

Stocks of old-crop wheat in the exporting countries of the Danube basin were probably larger on August 1, 1929, than in any of the preceding five years. Available supplies of wheat for the past six years (wheat crops less net exports) were approximately as follows in million bushels:

1923–24	225	1926–27	250
1924–25	180	1927–28	240
1925–26	250	1928–29	335

Thus these countries had available for all domestic uses fully 85 million bushels more wheat than in any other recent year. Population and per capita consumption for food alike appear to be increasing in this area; and the corn crop of 1928–29 was extremely short. The extent to which these factors, together with relatively low wheat prices as compared with most earlier years, tended to increase domestic utilization cannot be measured with any precision. Nevertheless it is a generally accepted doctrine that low prices tend to encourage the upbuilding of stocks here as in other countries, as well as to expand actual consumption. Even if an increase of 10 per cent occurred in actual consumption — an extremely liberal figure, as judged by data from other countries where information on consumption is far more adequate—there must still have been a marked increase in stocks during 1928–29, probably to much the highest level of recent years.

Among the importing countries of Europe, the situation clearly varied widely from country to country. Total available supplies (crops plus Broomhall's shipments to Europe) in the importing countries as a group were approximately as follows, in million bushels, for the past six crop years:

1923–24	1,615	1926–27	1,590
1924–25	1,485	1927–28	1,650
1925–26	1,625	1928–29	1,745

In this group of countries, as in the Danube basin, available supplies were larger in 1928–29 than ever before, by some 95 million bushels. In percentage terms, this increase is much less marked than in the Danube countries, and is more difficult to interpret. That stocks were as much as 80–88 million bushels larger on August 1, 1929 than on August 1, 1928, as Broomhall estimates,[1] is possible but not certain. If, as some observers maintain, the quantity of wheat fed to animals in 1928–29 was extraordinarily large, so great an upbuilding of stocks as 80 million bushels seems improbable, with available supplies only about 95 million bushels larger in 1928–29 than in 1927–28. On the whole, with allowances for growth of consumption, it seems reasonable to conclude that in the aggregate stocks on August 1 were considerably larger than at the end of any other postwar year except perhaps 1923–24. At the moment, more precise comparisons are hardly feasible; a good deal of light will be thrown on the situation by statistics of imports in ensuing months. The evidence is fairly convincing that stocks on August 1 were small rather than large in Spain, Portugal, the United Kingdom, and not distinctly large in Germany; but apparently much larger than usual in France and Italy especially, and to a less striking extent in the countries of central Europe. All told, European importing countries apparently entered the crop year 1929–30 in somewhat the same position regarding stocks as in 1924–25; the outstanding difference is not in the size of stocks, but in the size of the prospective crops, which are much larger this year than in 1924.

[1] *Corn Trade News*, July 17 and 24, 1929.

The situation in Russia is even more obscure; but stocks were presumably lower than on August 1, 1928, though not so low as they were following the short crops of 1923 and 1924.

Summary of Stocks

The importance of the world carryover of wheat into 1929–30 is such as to justify emphasis and an attempt to summarize the world position. Never before, at least in post-war years, has the wheat situation at the opening of a crop year involved on the one hand a relatively short crop and on the other an inward carryover of such magnitude as that of 1929–30. Unfortunately even rough numerical expression cannot be given to stocks in all countries. Table 2 shows such estimates as may be presented as accurate within reasonable but rather elastic limits; the figures involve only the stocks in major exporting countries, afloat for Europe, and in ports of the United Kingdom, and were reached by methods set forth in earlier pages.

Table 2.—Approximate Carryovers of Wheat in Exporting Countries, Afloat for Europe, and in Ports of the United Kingdom, August 1, 1924–29*

(*Million bushels*)

Location	1924	1925	1926	1927	1928	1929
United States[a]	165	135	111	138	142	262
Canada	41	26	35	48	78	104
Canadian in United States[b]	3	3	4	5	14	23
Argentina	66	56	61	65	80	100
Australia	38	36	30	41	40	43
Afloat for Europe	42	33	39	46	45	38
United Kingdom ports	10	9	4	8	10	6
Total	365	298	284	351	409	576

* Data summarized from Appendix Tables VII and XI, except as noted.

[a] Data as of July 1. Includes flour stock in city mills.

[b] Canadian wheat in store in lake and Atlantic ports of the United States. Data from *Canadian Grain Statistics*, as of dates nearest to August 1.

Total stocks in these positions reach about 576 million bushels in 1929, some 167 million more than in 1928 and 211 million more than in 1924. The United States Department of Agriculture estimated on July 15 that the carryover in somewhat these same positions as of July 1[1] might be expected to prove only 125 million bushels larger this year than last.[2] Broomhall, writing on July 31, estimated that stocks in about these same positions were around 172 million bushels larger in 1929 than in 1928. As we have seen, there is good reason to suppose that the Danubian countries hold larger stocks than they did in 1928 or 1924, and that European importing countries hold stocks larger than those of 1928, though probably little if any larger than those of 1924. India presumably has considerably smaller stocks than in 1924, and somewhat smaller than those of 1928. It is difficult, of course, to summarize with precision the situation of importers this year as compared with earlier years. On the whole, however, importing countries may be said to have in sight or at least available to fill their requirements much more old-crop wheat, domestic and in exporting countries together, than they have had in any of the preceding five years. The fact is of particular significance in evaluating the international statistical position for 1929–30 in comparison with the positions in 1924–25 and 1925–26.[3]

III. WHEAT PRICE MOVEMENTS

The Course of Prices

Fluctuations in wheat prices during April–July presented features of unusual interest. In the United Kingdom and in the principal exporting countries, prices declined fairly steadily and extensively during March–May, an occurrence unprecedented since 1910 in these months of the year. During June–July, particularly in the middle four weeks of the period, prices rose precipitously—somewhat the most ex-

[1] The outstanding differences in compilation between our estimates and the Department's are that we include flour stocks in city mills in the United States, total stocks rather than the exportable surplus in Argentina, and stocks on farms, in mills, and in transit in Canada instead of the Canadian visible alone.

[2] The figure was revised to 136 million on August 15.

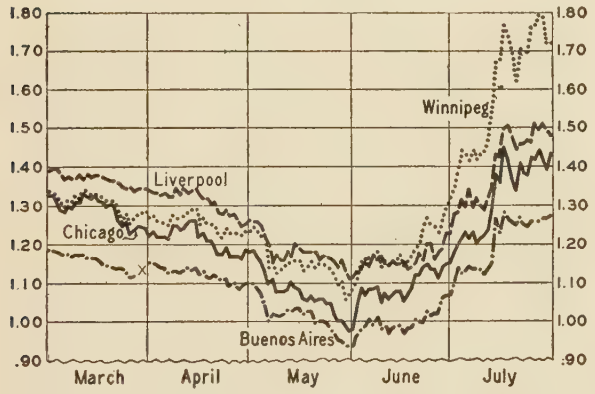
[3] See below, pp. 453–54.

treme rise recorded in post-war years in these months, but one resembling in its timing, extent, and causes the upswing of June–July 1924. As usual, diverse movements were shown as between cash and futures prices, and as between both cash and futures prices in different markets. It is impossible to present or analyze all of these diversities, and more difficult than usual to explain the general movements common to most markets.

Chart 3 shows the daily closing prices of July futures (August in Buenos Aires) in the world's leading markets. Ignoring

CHART 3.—DAILY CLOSING PRICES OF JULY WHEAT FUTURES IN LIVERPOOL, CHICAGO, AND WINNIPEG, AND OF JULY AND AUGUST FUTURES IN BUENOS AIRES, MARCH–JULY 1929*

(U.S. dollars per bushel)



* Data from *Daily Trade Bulletin, Chicago,* and *Times of Argentina,* Buenos Aires. The X indicates a change in future.

minor fluctuations for the moment, one may say that the general movement was downward throughout April and May, upward from June 1 to July 17, and thereafter without trend, though fluctuating rather widely from day to day.

The downward tendency during April–May was a continuation of a movement begun as early as February 15–20. In retrospect, the major factors in the decline appear to have been the pressure of extraordinarily heavy supplies of wheat (especially those in Argentina, which were continuously pressed upon the import markets after the huge new crop began to move in volume), coupled with a favorable outlook for new crops, especially of United States winter wheat. The March–May decline would of course have appeared less marked in the absence of an upswing in prices in January–February. Just as this upswing in prices reflected in part the influence of weather conditions which seemed to presage heavy winterkilling,[1] so the subsequent decline in prices represented in some part the accumulation of evidence that winterkill was not exceptionally extensive. To this were added, as the days passed, really favorable early growing conditions in the United States. One cannot accurately appraise how far the pressure of heavy stocks, how far favorable crop prospects, were responsible for the downward drift of prices; clearly the one influence supplemented the other. To judge by the comments in trade journals, however, the pressure of supplies was the more important. The central feature of the situation was pressure of offers by Argentine and Canadian exporters, and this pressure sprang primarily from the huge stocks available for sale; the crop outlook seemingly played a secondary though not a negligible rôle, if only because the outlook was at that time necessarily entirely obscure in Argentina, far from clear in Canada, and favorable and uncertain in the United States but unfavorable and uncertain in Europe.

The decline, as usual, was interrupted, and was more marked in some markets than in others. There was a slight bulge in prices from April 8 to 15, most marked in Chicago and scarcely apparent in Buenos Aires. This reflected, in its inception, expectations that the bills for farm relief to be introduced in the United States Congress after April 13 would in some way provide the means whereby the "burdensome surplus" might be removed from the domestic market; and, in its subsidence, disappointment over the bill as introduced. During the March–May period, the Chicago future declined more than any other; thus the spread between the Chicago and the Liverpool July futures was only 6 cents on March 1, but was 13 cents on May 31. Ap-

[1] Other influences were operative, among them the atmosphere engendered by a bullish stock market in the United States, hopes that legislative action to raise wheat prices might be taken, and a widespread feeling that prices had already moved downward about as far as could be expected.

parently the period represented an unsuccessful attempt at adjustment, whereby American prices should be brought into a relationship permitting an increase in exports which might bring the total for the year to a level more normal for a year of large domestic crop. The Winnipeg future on the whole declined less than the Liverpool—partly, perhaps, the expression of a seasonal movement, but more probably a reflection of deficient subsoil moisture in Canada, which (taken alone) augured a moderate or a short new crop.

In some journals[1] the decline in prices of April–May was attributed largely to "misdirected efforts to put up the price of wheat" in the United States, which took essentially the form of statements that railway freight rates must be reduced in order to move our burdensome surplus to export. It is impossible to ascertain how far the wide publicity given to these statements was responsible for the decline. Perhaps the emphasis placed upon our heavy stocks contributed somewhat by encouraging bearish sentiment. But in retrospect the decline seems more reasonably explicable, at least the larger part of it, by the joint action of actual heavy stocks and favorable crop prospects, as described above. The effect upon prices of reductions of railway freight rates both in the United States and Canada in the latter half of May is likewise uncertain. One cannot demonstrate conclusively that the benefit of the reductions accrued either to foreign importers and consumers or to American and Canadian exporters and producers. But it is pertinent to observe that British trade journals regarded the reduced rates as a depressing influence on the import markets and not all American journals regarded them as tending to maintain prices in United States markets; and that the evidence is fairly conclusive that the great advance in ocean freight rates in September–October 1926 (a reversed illustration of a change in costs of transport) tended to increase import prices rather than to decrease export prices.[2] Regardless of the incidence of the reduced rates effective in May, they were in themselves not large enough to have altered in a significant degree the broad picture of the decline in prices common to all four markets.

The advance in prices during June–July was spectacular, concentrated as it was practically within 30 days, from June 17 to July 17. Between these dates futures prices as shown on the chart moved upward 62 cents in Winnipeg, 39 cents in Chicago, 34 cents in Liverpool, and 31 cents in Buenos Aires. The maximum increase during June–July was larger — 70 cents in Winnipeg, 47 in Chicago, 39 in Liverpool, and 35 in Buenos Aires. In Chicago at least, there has not been so marked an increase in prices during these months over the whole period 1881–1928, excluding the war years. The closest analogy is with 1924. In that year, maximum increases during June–July amounted to 49 cents in Winnipeg, 33 cents in Chicago, 36 cents in Liverpool, and about 44 cents in Buenos Aires. In 1924, as in 1929, Winnipeg advanced more rapidly than the other markets, because crop damage was more marked in Canada than elsewhere. But the Liverpool and Buenos Aires markets advanced more rapidly in 1924 than in 1929, presumably because Argentina had a much smaller exportable surplus in 1924, and the European crop outlook was unfavorable. Chicago prices rose more this year than in 1924; explanations are not easy, in view of the much heavier stocks this year, but one may at least point out that the American crop outlook improved in 1924 but grew worse in 1929 during June–July, and that the supporting influence of farm relief legislation was not present in 1924.

Many interrelated factors were responsible for the sharp advance this year. Its inception appears to have been in the United States, where on June 3 and 4 encouragement was afforded to traders by dispatches from Washington which were interpreted to mean that governmental action would be taken to raise wheat prices after passage of farm relief legislation. The action of the Chicago markets was reflected in others, though not fully; and the spread between Chicago and Liverpool prices, which had widened to 13 cents on May 31, was narrowed again. For about

[1] See especially an editorial in *Northwestern Miller*, May 15, 1929, p. 619.

[2] See WHEAT STUDIES, January 1927, III, 152–56.

two weeks after June 4 the movement of prices was horizontal or slightly downward. During this period crop progress was on the whole favorable. Lack of subsoil moisture in Canada and drought in Argentina and Australia evoked comment as potential causes of damage, though not at the time actually damaging if rain should come later. The sustained and rapid rise in prices began about June 18 on news of heavy damage, as shown by threshing returns, to American winter wheat in the Southwest, and to reports of damage to spring wheat from continuing dry and hot weather both in the United States and Canada. Toward the end of the month crop reports from the United States winter-wheat belt became more favorable; but the continued drought in the North American spring-wheat belt gave rise to almost daily increases in prices during late June and the first half of July, except on occasional days of reaction or of reports of more or less rain. The greatest advances were recorded on July 13, 15, and 17—not, apparently, because these were the particular days in which crop damage was greatest, but rather because the sentiment of traders crystallized and speculative activity became marked. The volume of trading in futures on the Chicago markets was larger than ever before on June 15, 17, and 18, around 140 million bushels daily.[1] Probably the week ending July 20 witnessed the greatest activity in wheat futures trading known in post-war years, in Winnipeg and Liverpool as well as in the United States.

[1] The course of speculative activity, as shown by the average daily volume of futures trading in all United States markets, was as follows, in million bushels during April–July 1924–29:

Year	April	May	June	July
1924.....	18.0	14.4	34.0	53.3
1925.....	59.3	60.3	67.6	56.2
1926.....	55.8	48.8	46.3	57.5
1927.....	33.8	50.4	44.8	40.7
1928.....	66.2	56.6	36.2	39.8
1929.....	52.4	48.2	55.6	111.1

It is interesting to observe that, while trading was not of exceptional volume under the declining prices of April–May, it became relatively large in June, and quite without precedent in July.

Deterioration of the North American spring-wheat crop continued after July 18; but reports of damage lost much of their force, as was only natural after the extensive trading and huge advance in prices of July 15–18. To the end of the month prices fluctuated erratically, but scarcely exceeded the peak reached on July 17–18. On August 2–6 there were fairly sharp declines to a level 10–15 cents lower than the earlier peak, induced in some part by rather more favorable weather in Canada, but more by extremely heavy receipts of wheat at United States markets which accentuated the existing relative weakness in cash grain. But there were sharp upward recoveries in the week ending August 17, only to be followed by another decline.

A summary of the several factors influencing the price movement of June–July is perhaps desirable at this point, even if no device appears for attributing appropriate weight to each. The continued drought in Canada and the American spring-wheat belt now appears to have exerted the greatest influence toward price increase. Deterioration of the United States winter-wheat crop contributed to it, especially in its earlier phases; so also did continued drought in Argentina and eastern Australia, and expectations of governmental attempts at price-raising in the United States. The advance might have been greater in the absence of fairly consistent improvement in European crop prospects, and of huge stocks of wheat carried over from the crop of 1928, which created a relatively weaker situation on the cash than on the futures markets, especially in the United States. This situation, as in earlier months of the crop year, has maintained unusually wide spreads between near and distant futures in the United States and in Liverpool (the distant being at exceptional premiums), and has kept the July future in Winnipeg from standing at all close to its usual premium over the October.

European prices of domestic wheats failed to follow the movement of prices in exporting countries at all closely, especially in France and Italy, where stocks of old-crop wheat were large and the new crops promised well. In these countries prices were lower in the first half of July than they

had been in May.[1] In Germany, domestic prices followed the international market more closely. Prices in Hungary and Jugo-Slavia appear to have behaved in much the same manner as in France and Italy, and for similar reasons.

The Level of Prices

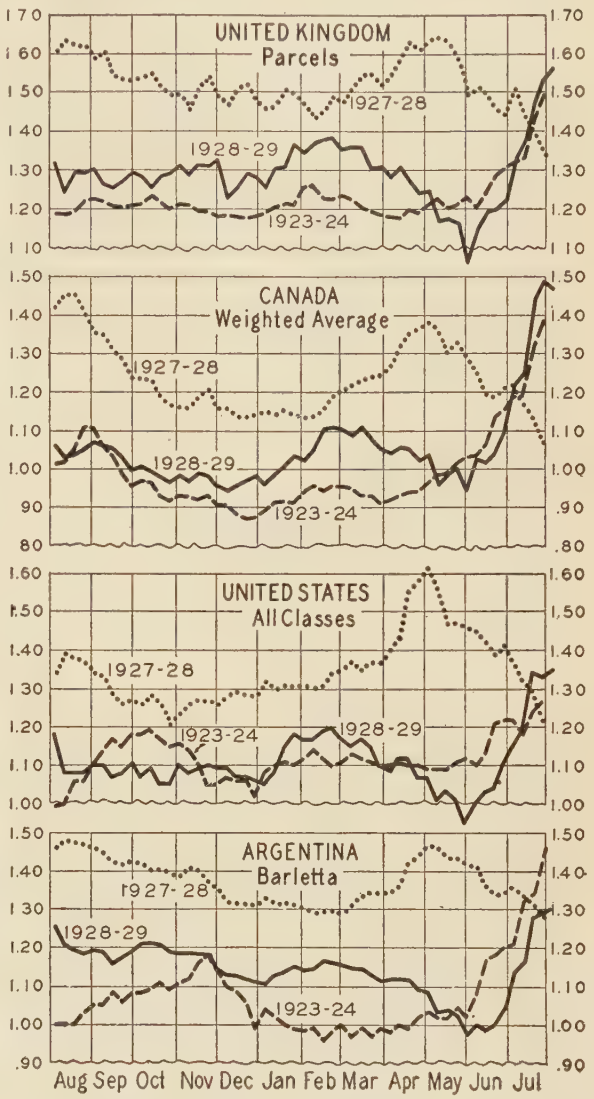
Chart 4 shows weekly average cash prices, weighted and unweighted, in the United Kingdom, Canada, the United States, and Argentina. It serves to emphasize the relatively low post-war level to which wheat prices were brought by the decline of April–May. At their lowest during the last week in May, parcels prices were over 10 cents lower than they were at any time in 1923–24, the year of lowest post-war prices. The other series, particularly for Canada and Argentina, show a less marked contrast. To a considerable degree this reflects the fact that different qualities and quantities of wheat enter into each of the various series as between the two years. Argentine Barletta wheat, for example, was undoubtedly of better quality than in 1924; and the weighted averages of United States wheat prices are made up from carlot sales in six markets (including Omaha, a relatively low-price market) in 1929 but only five in 1924. One may reasonably suppose that weighted average prices at Winnipeg failed to fall to as low a relative level as those in the United Kingdom and the United States principally because even so early in the season the deficiency of subsoil moisture in Canada tended to sustain prices there.

By the end of July, after the spectacular advance, the comparative level of prices was radically altered. Parcels prices stood at about $1.55 per bushel, not much higher than in the last week of July 1924, but about 20 cents higher than a year before. Canadian prices were 10 cents higher than in 1924, and over 40 cents higher than in 1928. United States prices were only about 6 cents higher than in 1924, and only 11 cents higher than in 1928. Argentine prices were about 15 cents lower than in 1924, and almost the same as in 1928. This contrast illustrates the joint effect of changing prospects for new crops and of existing heavy stocks. The details need not be considered here. It suffices to emphasize the fact that Canadian prices stood relatively high in relation to other markets because the Canadian crop outlook turned so markedly

[1] See Appendix Table X.

Chart 4.—Weekly Average Prices of Wheat in Leading Exporting and Importing Markets, 1923–24, and from August 1927*

(U.S. dollars per bushel)



* United Kingdom prices are averages of sales of wheat parcels in British markets, from *London Grain, Seed and Oil Reporter;* Canadian prices are weighted averages of different grades of wheat at Winnipeg (see Wheat Studies, March 1929, V, No. 5); United States prices are weighted averages of all classes and grades of wheat in six markets (five markets in 1923–24), from *Crops and Markets;* Argentine prices are Friday quotations from *International Crop Report and Agricultural Statistics,* for 1923–24, and averages of daily prices from *Revista Semanal* from August 1927. Argentine prices for the last two weeks are estimated from futures.

unfavorable, and that Argentine prices stood relatively low because of the existence of unusually heavy stocks of old wheat in Argentina.

The extreme advance of June–July did not suffice to bring wheat prices to a level notably high by comparison with earlier years. At about $1.53 per bushel, British parcels prices were some 33 cents higher than they were at the end of July 1923 and about 19 cents higher than in 1928; but they were about the same as in 1924, and were 21 cents lower than in 1925, 18 cents lower than in 1926, and 7 cents lower than in 1927. Yet it is probable that the outlook for new crops for the world as a whole was worse than in any of these years—even in 1924, if we consider that (disregarding carryovers) much more wheat must be produced in 1929 than in 1924 in order to satisfy increased demand at equivalent prices. From this point of view also the significance is brought out of the huge stocks carried out of 1928–29. Without them, the level of prices must inevitably have proved much higher.

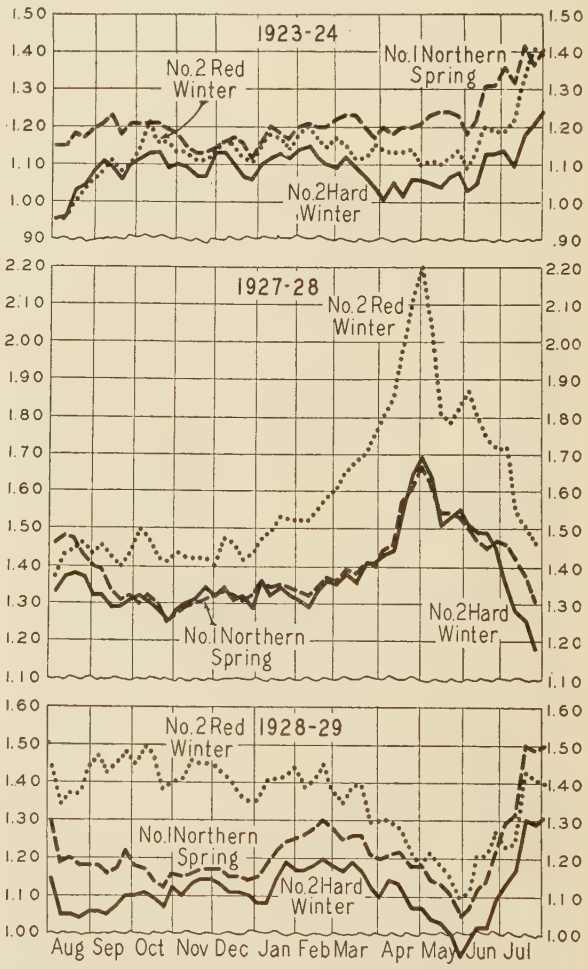
United States Cash Prices

Chart 5 shows the course and level of weekly weighted average prices of important grades of United States wheat, with comparisons. The transition to the new crop year brought significant changes in relationships. No. 2 Red Winter wheat at St. Louis continued to sell at higher prices than the other two grades until the first week in July, though its premium over No. 1 Northern at Minneapolis was much reduced in April–June from what it had been in earlier months. This reduction in premium represented the outlook for a fairly good crop of soft red winter wheat, considerably larger than the crops of 1927 and 1928. In the course of June and July, as the outlook for spring wheat became increasingly bad, the prices of No. 1 Northern rose much more rapidly than the prices of either No. 2 Hard or No. 2 Red Winter; the increase from the low point at the end of May to the peak at the end of July was 44 cents, 35 cents, and 31 cents respectively.

Throughout most of the crop year 1928–29, cash wheat in the principal markets of the United States has remained cheap relative to futures, a phenomenon traceable to the persistently large commercial stocks, and related to the exceptional premiums of distant futures over the near. The situation was necessarily a favorable one for any dealer or miller in a position to buy cash wheat of contract grade, hedge it in a distant future, and store it for future delivery; it was this situation, itself a result in part of restricted exports, that was the immediate though not the fundamental cause of the huge accumulation of wheat stocks in elevators and in mills characteristic of the crop year.

Chart 5.—Weekly Average Cash Prices of Typical Wheats in United States Markets, 1923–24, and from August 1927*

(U.S. dollars per bushel)



*No. 2 Red Winter at St. Louis, No. 2 Hard Winter at Kansas City, and No. 1 Northern Spring at Minneapolis. Data from *Crops and Markets*.

Toward the end of the year, as the flow of new-crop wheat became more than seasonably heavy, the weakness of cash wheat prices relative to futures appears to have been accentuated, a natural result with storage space already well filled. In Chicago, cash wheat in mid-August sold at times for 8 cents under the September future, with only a few weeks to carry the wheat to delivery. The f.o.b. prices of cash wheat at Gulf ports declined to unusually low levels in relation to Chicago futures prices as wheat from the new crop (which could not be moved to inland terminal centers largely on account of differentials in freight rates) came forward in volume. This situation, rather than any readjustment of Chicago to Liverpool prices, permitted fairly heavy exports in July. Even so, f.o.b. prices were not sufficiently depressed to permit export sales large enough to cover arrivals from the country; and late in July temporary embargoes had to be put in effect at Galveston and Houston.

It is not clear that the reductions in railway freight rates ranging from 2 to 7 or 8 cents per bushel according to region made in the latter half of May had any measurable effect toward increasing the receipts of wheat at Gulf ports, though this is possible because the costs of transporting wheat from interior points to the Gulf ports were on the whole reduced rather more than the rates to interior terminal markets. It seems likely, however, that these reductions failed to enlarge the export movement from the United States as a whole; but even so much cannot be demonstrated conclusively in the absence of knowledge concerning what the export movement would otherwise have been.

With the new crop of wheat in the Southwest showing generally higher protein content than the crop of 1928, premiums for protein at Kansas City tended to decline in July and early August. This occurred at Minneapolis also, though at that market the decline in premiums was based more upon anticipation than upon actual experience with the new crop of spring wheat.

IV. INTERNATIONAL TRADE

The movement of wheat and flour in international trade was restricted during April–July. Nevertheless, the volume of trade for the crop year 1928–29, as was anticipated earlier in the year, was of record size. Broomhall's shipments for the crop year totaled 928 million bushels (this is the figure for 53 weeks; that for 52 weeks is 917 million), over 100 million bushels more than in any other year, and above his earlier estimates which were progressively increased from 824 million bushels in August 1928 to 896 million in May 1929. Preliminary data point to net exports of about 935 million bushels, some 15 million below our own estimate calculated in May. Huge crops in exporting countries, and extraordinarily heavy imports by ex-European countries encouraged by low prices, were the outstanding factors which account for the record volume of trade in 1928–29.

Volume and Course of Trade

According to Broomhall's data, as shown in Table 3, overseas shipments of wheat and flour during April–July reached 279 million bushels, a fairly large figure, but one slightly exceeded in the same months of 1924 and 1927, and almost equaled in 1928. Measured in terms of the percentage of the yearly shipments which occurred in

Table 3.—International Wheat and Flour Shipments (Broomhall) by Destination*

(*Million bushels*)

Year	April–July (18 weeks)			August–July (52 weeks)		
	Total	To Europe	To ex-Europe	Total	To Europe	To ex-Europe
1920–21	235.3	214.6	20.7	591.0	541.5	49.4
1921–22	206.1	181.3	24.8	647.1	546.7	100.4
1922–23	231.7	200.7	31.0	676.4	585.9	90.5
1923–24	283.3	246.0	37.3	775.3[a]	626.5[a]	148.8[a]
1924–25	188.2	169.2	19.0	715.2	639.7	75.5
1925–26	225.4	190.0	35.4	667.6	532.3	135.3
1926–27	282.5	233.3	49.2	814.4	682.4	132.0
1927–28	268.2	218.0	50.2	792.8	661.8	131.0
1928–29	278.9	213.7	65.2	928.1[a]	703.1[a]	225.0[a]
Average						
1909–14	218.2	189.7	28.5	624.7	542.7	82.0
1923–28	249.5	211.3	38.2	753.0	628.5	124.5

* Data from Broomhall's *Corn Trade News*.

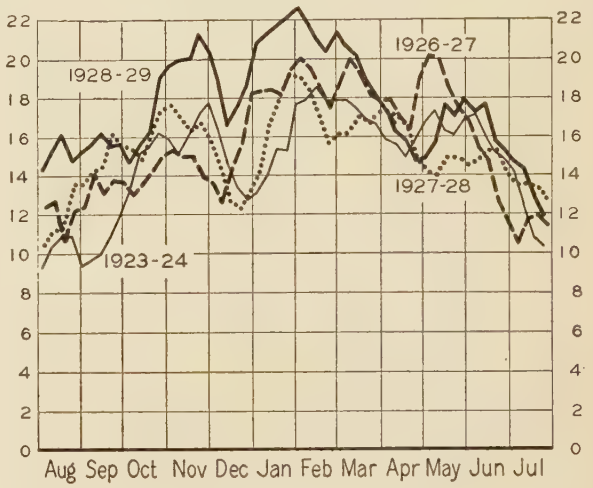
[a] Fifty-three weeks.

August–July, however, the movement this year was distinctly small. April–July shipments constituted only 30.1 per cent of the crop-year total, as against 36.5 per cent in 1924, 34.6 per cent in 1927, and 33.8 per cent in 1928. This is the smallest figure since the war except for 1925, when prospects for a large European crop following a very short one curtailed shipments to such an extent that only 26.3 per cent of the total movement in 1924–25 occurred in the closing four months of the crop year. The events of 1929 thus were such as to result in a fairly sharp year-end reduction in overseas exports from the levels which were reasonably to be anticipated under normal progress of new crops and in the absence of any radical change in wheat prices.

It is impossible to segregate all of the influences bearing upon this reduction. Chart 6 shows Broomhall's weekly shipments in terms of three-week moving averages, and permits analysis of the periods in which the most striking reduction took place. The seasonal trough was perhaps exceptionally low in April, at least for a year in which shipments had previously been maintained on such high levels. The peak in late May and early June, which always accompanies the opening of navigation on the Great Lakes, seems decidedly low in view of the huge stocks accumulated in Fort William and Port Arthur and in Duluth-Superior. It is likely that declining prices in April–May evoked resistance by exporters which tended to curtail the export movement, especially in Australia; and importers, faced with an outlook for large new crops practically throughout the Northern Hemisphere, may have curtailed their purchases on the declining market. These hypotheses are difficult to corroborate, for it is never feasible to ascertain with precision exactly how importers operate, since at times they buy actively on a falling market, at other times on a rising market. Explanation of the sharply declining world shipments in June–July is easier to find. With crop prospects turning unfavorable in North America and world prices rising, holders in Canada and the United States especially were encouraged to refrain from pressing their offers despite the heavy stocks; and importers, faced with a favorable outlook for European crops and with liberal stocks everywhere, were encouraged to resist the price advance and to curtail their purchases. Somewhat the same thing occurred in June–July 1924, though in that year European crop prospects were less favorable.

CHART 6.—INTERNATIONAL SHIPMENTS OF WHEAT AND FLOUR, WEEKLY, 1923–24, AND FROM AUGUST 1926*

(Million bushels; 3-week moving average)



* Broomhall's data, from the *Corn Trade News*.

SOURCES OF EXPORTS

In the aggregate, the movement of wheat from exporting to importing countries during April–July was fairly close to our expectations expressed in May,[1] though somewhat below. The quantities furnished by the several countries were more markedly different. The actual movement is shown, with comparisons, in Table 4. Canada exported considerably less wheat and flour than we anticipated earlier; Argentina, the United States, and the Danube countries exported somewhat more; Australia somewhat less.

In view of the record accumulation of stocks in the United States, April–July exports were remarkably small, only 42.8 million bushels, the smallest figure of the past seven years except 1924 and 1928. Do-

[1] See WHEAT STUDIES, June 1929, V, pp. 212–14.

mestic prices remained too high as compared with prices in other exporting countries, notably Argentina, to permit exportation consistent with the size of domestic supplies. The situation was one established in the early months of the crop year 1928–29, and is scarcely amenable to discussion in brief space.[1] The April–July movement was of about the magnitude to be expected from analysis of the seasonal movement of net exports in past years, but slightly larger on account of a considerable spurt of exportation in May, when net exports reached 14.6 million bushels. Some 6 million bushels of the May exports consisted of wheat (presumably durum) moved from Duluth at the opening of navigation. Without these exports from Duluth, the April–June exports of 30.3 million bushels would have approximated our estimate of 25 million more closely, and net exports (including shipments to possessions) for the crop year July–June would have fallen almost exactly at our May estimate of 140 million bushels rather than 7 million above. No complete readjustment of Chicago futures prices to those at Liverpool occurred in July, and July net exports of 12.6 million bushels were accordingly small in view of the heavy carryover, the fairly large new crop in the Southwest, and rapid marketing. They were some 7 million bushels larger than the exports of July 1928, however; hence net exports (including shipments to possessions) from the United States for the crop year August–July totaled 154 million bushels.

TABLE 4.—INTERNATIONAL SHIPMENTS AND NET EXPORTS OF WHEAT AND FLOUR FROM PRINCIPAL EXPORT AREAS, APRIL–JULY, 1922–29*

(*Million bushels*)

April–July	International shipments (Broomhall)								Net exports from			
	Total	North America	Argentina	Australia	Russia	Balkans	India	North Africa and Chile	United States	Canada	Argentina	Australia
1922	206.4	105.6	61.2	36.8	...	2.8[a]	....	...	55.7	47.8	58.1	32.3
1923	231.6	131.9	60.7	15.8	...	4.7[a]	18.5	...	45.1	66.2	57.1	18.0
1924	283.3	144.0	86.4	29.9	4.0	7.1[a]	11.8	...	28.4	103.0	75.6	28.8
1925	188.0	104.2	31.0	44.3	...	4.0[a]	4.5	...	43.4	54.2	31.8	48.9
1926	224.8	138.8	42.0	22.8	7.6	7.6	3.4	3.0	45.9	83.9	38.7	22.8
1927	283.2	141.6	71.2	48.8	8.0	5.6	7.6	.4	50.7	82.6	65.7	44.6
1928	268.0	144.8	74.4	33.2	0.0	7.2	3.6	4.8	25.9	106.4	62.4	30.4
1929	278.9	144.8	89.1	33.4	0.0	9.1[b]	.2	3.3[b]	42.8	92.0	86.7	31.0[c]

* Shipments figures are Broomhall's cumulative totals for eighteen weeks from the *Corn Trade News*. These totals and their distribution differ slightly from the totals in Table 3, p. 447, and the weekly data given in Appendix Table V. Net exports are official data.

[a] Includes also shipments from other areas.

[b] Approximate distribution.

[c] June and July exports estimated from Broomhall's shipments.

Canadian net exports of 92.0 million bushels during the four closing months of the year were notably small in view of the accumulation of stocks remaining in the country on March 31. In 1928, when Canadian stocks on March 31 were 225 million bushels, net exports in April–July reached the record figure of 106 million bushels. This year, with stocks on March 31 almost 20 million bushels larger, net exports might reasonably have been expected to prove larger, but in fact they were 14 million bushels smaller. In general, the smaller exports this year reflect the much less favorable outlook for the new crop, particularly in June–July, and the attendant increase in Canadian prices relative to those in other export markets. Canadian net exports of 20.7 million bushels in July especially were smaller in 1929 than in 1928, by some 15 million bushels. The distinctly unfavorable progress of the new crop thus serves largely to explain why Canadian net exports of 406 million bushels for the crop

[1] See above, however, p. 438. We shall deal more fully with this subject later, in our review of the crop year 1928–29.

year August–July 1928–29 fell below our May forecast of 430 million bushels.

Argentine net exports of some 87 million bushels in April–July were of record size for the period, as December–March exports had been. The huge crop of 1928, by far the largest of any on record, was clearly responsible for the extremely large exports in both periods. There is no evidence suggesting that wheat has at any time been hurried out of Argentina at a more rapid rate than usual; stocks seem to have been built up; and the export movement might indeed have been greater in the absence of a dockers' strike at Rosario, the leading shipping port, during the last half of July. As we have attempted to show above,[1] the crop of 1928 now seems to have been larger than the evidence earlier available led us to suppose, and this accounts for the fact that April–July and August–July net exports from Argentina somewhat exceeded our May forecasts.

Australian exports of some 31 million bushels were somewhat smaller than was to be expected from the size of the crop of 1928 and the usual seasonal movement of exports. Net exports in April, 11.7 million bushels, were not strikingly small; but with declining prices in May they fell to a much lower level and, so far as can be judged from Broomhall's shipments, were smaller in June and July 1929 even than in 1928. Unfavorable new-crop prospects seem to have restrained the export movement somewhat in June and July.

Among the minor countries ordinarily listed as exporters, the Danube and northern African countries continued to export moderate quantities of wheat. Hungary and Jugo-Slavia, in particular, with large stocks of old wheat and with fair new crops in prospect, shipped rather large quantities in June and July as world wheat prices rose sharply. In July, for the first time in the crop year 1928–29, appreciable exports were shipped by these countries to western Europe; and for some weeks Danubian wheat was offered at even lower c.i.f. prices than Argentine, which had persistently undersold comparable types for months. India shipped very little, some of her shipments being re-shipped Australian wheat, and was a net importer in April, May, and June. As in earlier months, Russia neither exported nor imported appreciable amounts of wheat. Confidently expressed and frequently reiterated expectations that Russia must import considerable quantities in the course of the crop year were not fulfilled.

[1] See p. 439.

[2] See Appendix Table V.

Distribution of Imports

An outstanding feature of the distribution of April–July imports was the relatively large quantity of wheat shipped to ex-European destinations. According to Broomhall's shipments data summarized in Table 3 (p. 447), ex-European countries took some 65 million bushels of wheat during the period, 15 million more than in 1928, when April–July shipments to these countries were previously largest. This quantity was 23.4 per cent of all shipments, as against 18.7 per cent in 1928. In August–March, shipments to ex-Europe constituted 24.6 per cent of total shipments; hence there was a slight decline in the relative proportion of ex-European takings. That the proportion remained so large was due chiefly to heavy purchases encouraged by declining prices in April–May. With rising prices in June–July, purchases became much smaller in amount, but shipments of supplies previously contracted continued at a high level.[2]

The distribution of Broomhall's shipments to ex-Europe in the closing eighteen weeks of 1928–29 is as follows, in million bushels:

Destination	April–July 1927–28	April–July 1928–29
Central America[a]	25.2	24.9
China and Japan	10.2	17.2
Brazil	8.7	10.8
Egypt	3.8	5.0
North and South Africa	2.2	1.6
India[b]	0.0	4.7
Others	0.1	1.0
Total	50.2	65.2

[a] Includes Venezuela, West Indies, Dutch East Indies, etc.
[b] Chile, Peru, Syria, Palestine, New Zealand.

Larger shipments to China and Japan, India, Brazil, and Egypt in 1929 than in 1928 account for the major part of the increased ex-European takings. In the aggregate the

increase over 1928 reflects the relatively low prices of wheat which prevailed until near the close of the crop year 1928–29. It is worthy of note that shipments of 4.7 million bushels to India, though larger than in 1928, were much smaller than they had been in December–March, on account of the advent of the new crop in March–May.

A satisfactory analysis of the distribution of European imports during April–July is not at the moment feasible in the absence of official net import statistics for July. Broomhall's distribution of shipments is inadequate because so much wheat is recorded as shipped "to orders," and because wheat does not reach the designated destinations in the quantities set forth. Shipments to Europe by destination in the closing 18 weeks of 1928–29 and 1927–28 were, however, as follows, in million bushels:

Destination	April–July 1928	1929
Orders	53.7	45.8
United Kingdom	55.0	49.2
France	10.4	15.2
Italy	24.4	21.2
Germany[a]	19.7	19.7
Belgium	20.2	23.9
Holland	17.2	19.3
Scandinavia	5.1	6.1
Greece[b]	5.8	5.7
Spain[c]	2.0	3.1
Austria[d]	4.5	4.5
Total	218.0	213.7

[a] Includes Poland and Czecho-Slovakia.
[b] Includes Turkey.
[c] Includes Spanish colonies and Portugal.
[d] Includes Malta.

In the aggregate, shipments of 214 million bushels to Europe were relatively small, quite the reverse of shipments to ex-Europe. In absolute terms, larger shipments to Europe had been made in four of the preceding eight years, not only in 1928, but also in 1927, 1924, and 1921. In terms of the percentage of the total crop year's shipments to Europe, April–July shipments in the past eight years have constituted from 33 to 40 per cent except in 1925, when the percentage was 26.5. This year the April–July shipments were only 30.4 per cent of the crop year (53-week) total, so that the movement of wheat and flour to Europe in the last third of the year in relation to the movement in the preceding months was distinctly on the small side. This resulted from the rising prices of June–July, together with the promising outlook for the European crop. In the same months of 1925, the causes of reduced takings by Europe were falling rather than rising prices, together with a favorable outlook for domestic wheat crops.

According to Broomhall's data, most European countries imported rather more wheat in April–July 1929 than in 1928. Great Britain, Italy, and Greece were the chief exceptions, and it was the smaller takings of these countries combined with smaller shipments to orders that brought the 1929 total below that of 1928.

Net import statistics for April–June in some instances support inferences to be drawn from Broomhall's data, but in other instances they do not. For the principal importing countries of Europe, April–June net imports were as follows, in million bushels:[1]

	April–June 1928	1929
Great Britain[a]	75.9	76.0
Italy	34.3	26.3
Germany	21.8	20.9
France	6.3	17.2
Belgium	9.8	10.6
Holland	7.2	7.0
Switzerland	3.2	4.8
Scandinavia[b]	6.6	10.8
Czecho-Slovakia	4.9	3.8
Poland	5.0	.3
Total	175.0	174.7

[a] April–July, including an estimate of July net imports of the Irish Free State.
[b] Norway, Denmark, and Sweden.

British imports were not smaller this year than last, as Broomhall's data suggest, but were a trifle larger. April–May imports were not only larger this year, but were the largest in five years; but June and July imports, especially the July, were the smallest in five years. Apparently British importers succeeded in concentrating their imports in the periods of lowest prices.

Italian imports were much reduced this year in April–June. Imports earlier in the year had been extraordinarily heavy, when imported wheat was cheap in relation to domestic on account of the marketing tac-

[1] See Appendix Table IV for monthly data in 1929.

tics of Italian producers. In the final months of the year domestic supplies became cheap in relation to foreign, as these tactics were altered on the prospect of a large new crop, and imports were reduced. An increase of the tariff effective on May 23 induced fairly heavy imports in anticipation of it. The marked increase in French imports was in part a reflection of the relatively low world prices of wheat prevailing throughout most of 1928–29; but some stimulus to importation in April–June was afforded by an increase of the tariff, also on May 23, as well as by restricted offerings by domestic producers. The German tariff was raised on July 10, and here also imports were heavy in anticipation of the change; prior to April, German imports had been much smaller in 1928–29 than in 1927–28. For other countries the contrasts require no comment, the differences between April–June imports in 1929 and 1928 being much the same as those between August–March imports, and traceable to factors bearing on the two crop years rather than the final months of either. The absence of July net import statistics precludes analysis of the effect of rising prices and new-crop prospects upon importation into the various countries at the end of the crop year.

V. OUTLOOK FOR THE NEW CROP YEAR

Northern Hemisphere Crops of 1929

Available data on crop production in 1929, though by no means complete or accurate at the date of writing, are nevertheless adequate to illustrate certain sharp contrasts and similarities between the supply position this year and those of other years, especially 1924 and 1928. Table 5 shows in a tentative form an important feature of the supply situation, the size and distribution of Northern Hemisphere wheat crops. The italicized figures for 1929 contain a considerable element of our own estimation, on bases set forth above;[1] for earlier years such figures represent our own corrections of standing official crop estimates in Argentina, Canada, and the United States.[2] Figures in roman type for all years are official or predominatingly so. The distribution of the Northern Hemisphere crop of 1929 on the whole resembles that of 1925 more closely than any other crop of recent years. In 1925 the North American crop was larger than that of 1929, though not strikingly so; and the crops of the Danube countries, European importing countries, northern Africa, and India were much the same in size, though a little larger in the aggregate.

Less is known of the outturns of direct and indirect substitutes for wheat, which are of greater importance in Europe than in North America. Current reports suggest that the rye crop in Europe will be above average in size, probably not so large as in 1928 or 1925, but much larger than in 1924. The corn crop also promises well, much better than in 1928 and perhaps as well as in 1924 and 1925; and outturns of barley and oats seem likely to be above the average of recent years. All told, European outturns of rye and the feed grains may reasonably be expected to equal or perhaps slightly to exceed those of 1928, to prove far larger than they were in 1924, and at least to equal those of 1925.

The total crop of the Northern Hemisphere (excluding Russia, China, and Asia Minor) roughly approximates 2,900 million bushels, one of the smallest in recent years. At this figure, it is over 200 million bushels larger than the short crop of 1924, but probably 450 million bushels or more smaller than the huge crop of 1928.[3] By comparison with 1928, the crop of 1929 is notably shorter only in the spring-wheat belt of North America and in the Danube countries, areas which produced exceptionally large crops in 1928. Other areas apparently have somewhat larger crops. By comparison with 1924, the striking contrasts are more numerous. The United States and India have much smaller crops this year, while European importing countries, the

[1] See pp. 432–34.

[2] See Appendix Table XI.

[3] In this comparison we give weight to apparent official underestimates of the crops of the United States and Canada in 1928. See above, pp. 438–39.

TABLE 5.—WHEAT PRODUCTION IN PRINCIPAL PRODUCING AREAS, PRE-WAR AND POST-WAR*

(*Million bushels*)

Year	United States	Canada	Soviet Russia	Lower Danube[a]	Other Europe	North Africa	India	Japan, Chosen	Northern Hemisphere ex-Russia[b]	Argentina	Australia	Southern Hemisphere	World ex-Russia[b]
1922.....	868	400	...	224	815	71	367	40	2,800	196	109	354	3,155
1923.....	797	474	419	260	989	106	372	35	3,050	248	125	427	3,475
1924.....	864	*275*	472	204	846	85	361	35	*2,685*	191	165	407	*3,090*
1925.....	*700*	*430*	730	296	1,094	105	331	40	*3,010*	191	115	360[c]	*3,370*[c]
1926.....	*870*	*415*	820	294	910	90	325	41	*2,955*	221	161	435[c]	*3,390*[c]
1927.....	878	480	749	272	988	106	335	40	3,115	*275*	117	*460*[c]	*3,575*[c]
1928.....	902	534	860	369	1,040	104	293	39	3,295	307	161	529[d]	3,825[d]
1929.....	774	*260*	...	297	*1,080*	*120*	318	41	*2,900*	...	...	...	.....
Average 1909–13...	690	197	759[e]	330	1,017	93	352	32	2,725	147	90	280	3,004
1923–27...	*822*	*415*	638	265	965	98	345	38	*2,960*	*225*	137	*418*	*3,380*

* Summarized from most recent official data for individual countries (see Appendix Table I), as reported by the U.S. Department of Agriculture, and International Institute of Agriculture, but figures in italics represent our adjustments for apparent underestimates of crops, as shown in Appendix Table XI, for years prior to 1928. Italicized figures for 1929 represent our approximations. Totals exclude China, Asia Minor, Brazil, and a number of small producers. All estimates are for areas within post-war boundaries.

[a] Hungary, Bulgaria, Roumania, Jugo-Slavia.
[b] Rounded figures.
[c] Includes our estimate for Peru.
[d] Includes our estimate for Peru and Chile.
[e] Regarded as too low by some Soviet officials, whose estimate is 908 million bushels.

Danube countries, North Africa, and Russia[1] as well have much larger ones.

THE STATISTICAL POSITION

Any attempt to evaluate with precision the statistical position for 1929–30 in contrast with earlier years is tentative at this season. Further information is needed bearing upon the harvests in most Northern Hemisphere countries, and the crops of the Southern Hemisphere remain to be made. Certain aspects of the position have already become obvious, however.

The margin between export surpluses and import "requirements" can hardly prove as wide as it was in 1928–29. Both import "requirements" and export surpluses are clearly smaller for 1929–30 than for 1928–29. Europe needs to import less wheat because larger crops of wheat and perhaps of feed grains, and larger carryovers of rye and wheat, must more than offset the annual increase in consumption. Ex-European countries also need to import less, if only because India, Egypt, and Asia Minor have larger crops. On the other hand, exporting countries will have much less wheat to export; inward carryovers, it is true, were far larger in the aggregate this year than last, but the reduction in the North American and Danubian crops much more than offsets this and even the best possible weather in the Southern Hemisphere could hardly result in crops there sufficiently large to compensate the deficiency. The probable net reduction in export surpluses is large enough considerably to exceed the net reduction in import requirements. A tighter international statistical position in 1929–30 than in 1928–29 is already established, whatever subsequent crop progress may be. How much tighter the position will prove this year than last is another matter, and in this determination the development of Southern Hemisphere crops in particular, but also of the European, will be of vital significance.

In the past seven years the statistical position was clearly tightest in 1924–25 and 1925–26, easiest in 1923–24 and 1928–29. The striking resemblances between the transitions from 1923–24 to 1924–25 and from 1928–29 to 1929–30 have evoked much comment from observers of the world wheat situation. In both years the transition was from a decidedly easy to a tighter international statistical position; in both years Canada experienced a reversal of crop prospects; in both years prices rose precipitously in June and July, and the

[1] Although no Russian production forecast is available for 1929, it seems clear that the crop will far exceed the short one of 1924.

movement of wheat in international trade fell off sharply; in both years carryovers were large in exporting and importing countries.

But there are no less striking differences. The most significant among these is that the world carryover on about August 1 was far larger in 1929 than in 1924; that European importing countries are harvesting crops of wheat so much larger than those of 1924 as to bring the Northern Hemisphere crop (ex-Russia and China or ex-China alone) well above that of 1924; and that the European crop of rye and the feed grains promises much to exceed the crop of 1924. Even with distinctly liberal allowances for growth in wheat requirements, it seems reasonable to suppose that world import requirements in 1929–30 must prove smaller than they were in 1924–25, partly because Russia seems less likely to require imports in the coming year. With Southern Hemisphere crops still to be made, it is more difficult to perceive whether export surpluses will prove larger or smaller than they were in 1924–25. If crops alone determined export surpluses, there would be less wheat available for export in the Northern Hemisphere in 1929–30 than in 1924–25; increases in the Danube and northern African crops might about offset decreases in the Indian, but North America could furnish less. But carryovers as well as new crops are important; and on the whole the inward carryover in the United States and Canada seems so far to exceed the carryover into 1924–25 that it fully offsets the smaller crops. Thus total exportable surpluses in the Northern Hemisphere in 1929–30 are presumably as large as or larger than those of 1924–25. If these alone needed to be considered, the statistical position would clearly be easier than it was in 1924–25, since export surpluses would be approximately similar in size while import requirements are smaller. The final outcome depends partly upon further developments in Northern Hemisphere crops, which may finally prove either smaller or larger than the tentative figures shown in Table 5; but the outturns in Argentina and Australia are of major importance. If these countries together harvest crops about like those of 1924 or considerably larger, the statistical position in 1929–30 is likely to prove easier than in 1924–25. Seemingly only a decidedly short crop could make it equally tight.

As we have seen, the distribution of the Northern Hemisphere wheat crop of 1929 resembles that of 1925 more closely than any other in recent years. Taken alone, this distribution suggests a statistical position in 1929–30 not far different from that of 1925–26—if anything a little tighter because import requirements may well be larger this year and export surpluses smaller. But inward carryovers, especially in North America, were far larger this year than in 1925. Moreover, to some degree the tight position in 1925–26 was attributable to the poor quality of European crops, which thus far in 1929 seem to be of fairly good quality. In 1925–26 the Southern Hemisphere crops were the smallest of any harvested during 1922–28, and the Argentine in addition was of notably poor quality. If Argentina and Australia this year harvest equally poor crops, the statistical position may differ little from that of 1925–26, but it can hardly prove tighter in view of the far larger world inward carryover this year.

Thus, so far as we are able to adjudge the situation, the international statistical position in 1929–30 on the whole seems likely to prove somewhat easier than those of 1924–25 and 1925–26, but tighter than those of 1923–24 and 1928–29. The range of possibilities remains a rather wide one; but more precise comparisons will become feasible only when the approximate size of new crops in the Southern Hemisphere can be anticipated more confidently, and when more is known about outturns in North America and Europe.

International Trade

The foregoing analysis of the distribution of 1929 wheat crops and of the international statistical position carries certain implications concerning the movement of wheat in international trade during 1929–30. The contrasts with 1928–29 will necessarily be marked.

The total volume of trade must unquestionably fall far below that of 1928–29.

European importing countries require less wheat because they have larger crops and inward carryovers; ex-European countries will import less partly because India, Egypt, and Asia Minor have larger crops, and partly because a higher level of wheat prices will lead most other ex-European countries, especially China, to purchase much less freely; exporting countries have less wheat to export. Smaller ex-European imports imply a smaller volume of trade in flour especially, and therefore a less satisfactory year for American and Canadian millers.

With her short crop Canada will inevitably export less wheat and flour than in 1928–29. Less Canadian wheat will be imported into the United States for milling in bond; and much smaller shipments from Vancouver are in prospect. The United States will probably export more at a higher level of prices, despite the smaller crop. The existence and possible operations of the new Federal Farm Board may change the outlook. The Danube countries as a group may also export more than in 1928–29, despite the smaller wheat crop. Whether Russia will export wheat is uncertain; exports are conceivable if world prices rule sufficiently high and the collecting agencies choose to pay high prices to producers, and imports are unlikely both because of the prospective level of world prices and the (apparently) good crop of cereals. India may import (net) a little if prices decline from the level of early August, but is unlikely to import as much as in 1928–29 unless the crop of 1930 is decidedly small. She may export (net) a little if prices remain high or rise appreciably and the crop of 1930 promises well. Poland may possibly become a net exporter, as she was in 1925–26, if her crop is large enough and prices are sufficiently high. The French dependencies of northern Africa seem to be in a position to export more than in any other year. Argentina is unlikely to export as much wheat as in 1928–29 if only because a wheat crop of 1929 as large as the bumper one of 1928 is improbable. The outlook for Australian exports is less clear.

Among the European importing countries, Spain, Portugal, France, and Italy are almost certain to import less than in 1928–29 on account of their larger crops as well as higher prices of import wheat. Most other European countries may be expected to cut down their imports with higher prices. Great Britain, Holland, and Belgium, however, are possible exceptions, especially Great Britain.

The extent to which the volume of international trade in 1929–30 will fall below the record movement of 1928–29 depends in a large degree upon the course and level of prices and upon the outcome of crops remaining to be harvested and measured. That the volume of trade in 1929–30 must fall below that in 1928–29 may be taken for granted. In the five crop years preceding 1928–29, net exports ranged, in rounded figures, from about 700 million bushels in 1925–26 to about 850 million bushels in 1926–27. Exports in 1929–30 as small as those of 1925–26 are probable only in the event that prices rule even higher; for importing countries presumably would take somewhat more wheat at equivalent prices. At the moment, with the outcome of crops in many countries uncertain, and the course and level of international wheat prices obscure, the evidence scarcely justifies a guess at probable net exports in 1929–30 within a smaller range than 750–850 million bushels. The volume of trade in the closing months of 1929–30 will necessarily be affected by the prospects for crops in 1930.

Prices

Our analysis of the international statistical position implies little with respect to the probable level or course of wheat prices in 1929–30. At this date of writing, as we have seen, the statistical position can be adjudged only within a rather wide range of possibilities, for the size of too many important crops remains uncertain. Moreover, other less ponderable factors usually influence the level and course of prices. The most that can be said with assurance is that the statistical position of 1929–30 must certainly prove tighter than those of 1923–24 and 1928–29 even if the later harvested crops prove to be of record size. Whether the statistical position in 1929–30 will prove as tight as it was in

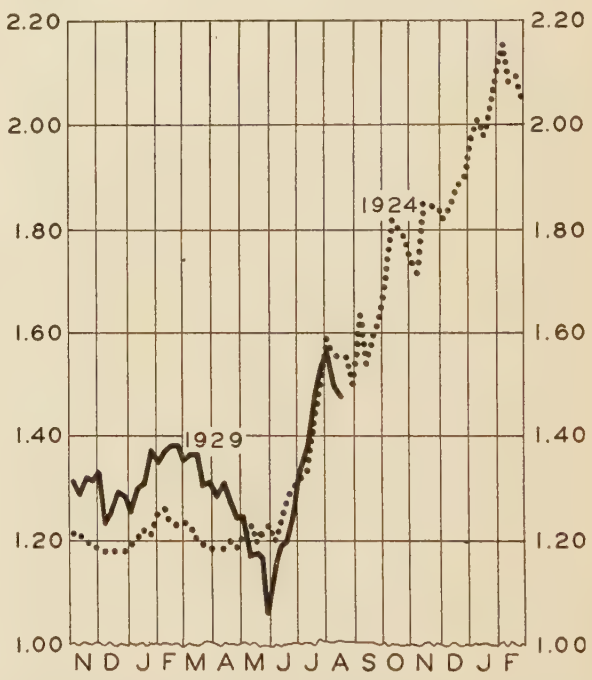
1924–25, when mid-winter prices reached the highest point in the past seven years, depends chiefly upon the outcome of Southern Hemisphere crops; but it seems likely to be equally tight only if these crops are extremely short. It seems unlikely, then, that the statistical position for 1929–30 will eventuate in a level of prices as high as in the winter months of 1924–25 or 1925–26. The price-making factors apart from the statistical position are less tangible and more difficult to appraise than the position itself, but appear to us unfavorable to a strong increase in prices during the autumn and winter months. In particular, the huge world carryover of wheat leaves little possibility of development of such fear of near-famine as played a large part in carrying prices sharply upward in 1924–25.

In view of the apparent similarities between the oncoming crop year and 1924–25, it is perhaps desirable to pursue further the comparisons which have been presented in earlier pages, with special reference to price movements. Chart 7 shows the fluctuations of British parcels prices in terms of weekly averages from November 1923 to February 1925, and from November 1928 to the middle of August 1929. The striking similarity of the upward movement in June–July 1924 and 1929 requires no further comment. The break in the upturn in August was similar in both years, and was apparently due largely to the same cause—extremely heavy marketing in the United States. But for present purposes the significant feature of the chart is the advance of prices during September–February 1924–25, and the pertinent question is whether or not the present situation so resembles that of August 1924 that an advance of equal magnitude may reasonably be anticipated this year.

In this connection one fact requires particular emphasis. The September–January advance in prices in 1924–25 was caused predominatingly by panicky buying by European importers.[1] This buying was induced partly by the decidedly short crop in Europe, together with a late and wet harvest, partly by over-pessimistic views respecting the inward carryover of domestic wheat, and partly by financial and economic recovery following the inauguration of the Dawes plan, which involved large loans especially to Germany. Speculative activity also contributed to the advance. Comparable developments clearly are not to be anticipated this year. European importing countries are assured of a large crop; the harvest is perhaps somewhat earlier and so far has encountered much less damage, though rain could still prove unfavorable; the inward carryover is admitted to be a large one; and the United States is seemingly in the process of contracting rather than expanding her loans to European countries. If prices in 1929–30 are to rise as extensively in September–January as they did in 1924–25, the advance must be induced by a far different set of circumstances from those operating in that year.

Chart 7.—Weekly Average Prices of Wheat Parcels in British Markets, November 1923 to February 1925, and from November 1928*

(U.S. dollars per bushel)



* Averages of sales from *London Grain, Seed and Oil Reporter*. The last two figures for August 1929 are estimated from Liverpool futures prices.

[1] For a discussion of the factors influencing wheat price movements in 1924–25, see Wheat Studies, November 1925, II, especially pp. 18–20, 34–40, and 48–49.

It is not altogether impossible that such an advance should occur. If persistently heavy rains should hamper the harvest in Canada and Europe, if threshing returns should prove present expectations of yields in the Northern Hemisphere considerably too optimistic, and especially if the growing crops in the Southern Hemisphere should deteriorate markedly, a rise in prices broadly similar to that of 1924–25 seems possible. But it can be made to seem probable only on the assumption that some such developments as the above are themselves probable.[1] And since sufficiently detailed long-range weather forecasts seem not yet to have become feasible, one cannot say with assurance that such developments are probable; they remain merely possible. On the other hand, it is equally possible that European weather should prove exceptionally favorable, that present expectations of yields should be considerably exceeded, and that crops in the Southern Hemisphere should show marked and progressive improvement. Under this set of circumstances international wheat prices might be expected to decline from their average level of the first half of August. The outlook, in short, is obscure.

It is obscure not only because crop outturns are not yet accurately known, but also because the year opens in the presence of certain elements never before witnessed in the price situation. The Canadian Pool in 1924–25 had not yet developed its facilities or technique for marketing wheat; hence, for the first time it will undertake, in 1929–30, the marketing of its fraction of a notably short Canadian crop under its newly developed methods. A recent merger of Canadian elevator interests has greatly concentrated control of that portion of the crop not handled by the Pool. These circumstances possibly have a bearing on the fact that Winnipeg new-crop futures, both October and December, have sold since mid-July at higher prices than Liverpool futures of the same delivery month; but it is also important to note that Argentina was never before in a position to ship so much wheat of good quality, that Liverpool futures were based chiefly upon Argentine wheat, and that the Canadian crop of 1929 is a very small one. Another element without precedent is the new Federal Farm Board in the United States; its direct or indirect influence upon wheat prices is not predictable.

In the course of the ensuing few months it will be of interest to observe whether Chicago futures prices continue to sell, as they have done for months, at prices only 10 cents or less below Liverpool futures, or whether the spread will widen appreciably. A wider spread seems necessary if American wheat is to move to export in large volume; yet it is clear that a great deal can move even at prevailing spreads — much Pacific wheat, durum, and various low grades, and considerable hard winter from the Gulf if cash wheat at Gulf ports is relatively cheap. On the whole, it is reasonable to count upon larger exports from the United States this year than last, and upon a reduction of the heavy stocks in the course of the year, with an accompanying tendency toward the reduction of the exceptionally large premiums of distant over near futures in American markets. This general development would be accelerated by a widening of the Chicago-Liverpool spread, but in our judgment is not dependent upon it.

In view of the exceptionally important rôle played by Argentina on the European wheat market for many months, we take it that a widening of the Chicago-Liverpool spread would occur in the event of notably poor progress of the growing Argentine crop. Such crop developments might bring Winnipeg futures prices into a more usual relationship with Liverpool prices; and might cause a marked upward movement in Liverpool futures or British parcels prices likewise. In the absence of serious crop damage in Argentina it seems probable that no drastic departure should be made from the recent level of international wheat prices, and it is possible that approximately the existing relationships of Chicago and Winnipeg to Liverpool futures prices should persist for some time to come.

Whatever the course and level of international wheat prices during the next six

[1] It is unnecessary to consider such eventualities as a war scare, inflation of currency, or a drastic increase in ocean freight rates, though any of these might give rise to an extreme advance in wheat prices.

months, fluctuations are likely to be more marked than in 1923–24 or the earlier part of 1928–29. Speculation in wheat will be more active, and markets will be more noticeably sensitive to news items such as revisions of crop estimates, most of which were given little attention in 1928–29, regardless of their magnitude.

This study is the work of M. K. Bennett, with the advice of Alonzo E. Taylor and Holbrook Working, and with the aid of Robert D. Calkins

APPENDIX

Table I.—Wheat Production in Principal Producing Areas, 1920–29*

(Million bushels)

Year	United States	Canada	India	Australia	Argentina	Chile	Uruguay	Hungary	Bulgaria	Jugo-Slavia	Roumania	Soviet Russia	Mexico
1920.....	833.0	263.2	377.9	145.9	156.1	23.2	7.8	37.9	29.9	43.0	61.3	.....	15.0
1921.....	814.9	300.9	250.4	129.1	191.0	23.6	10.0	52.7	29.2	51.8	78.6	.....	5.1
1922.....	867.6	399.8	367.0	109.5	195.8	25.9	5.2	54.7	32.6	44.5	92.0	.....	13.6
1923.....	797.4	474.2	372.4	125.0	247.8	28.1	13.3	67.7	29.1	61.1	102.1	419.1	13.7
1924.....	864.4	262.1	360.6	164.6	191.1	24.5	9.9	51.6	24.7	57.8	70.4	472.3	10.4
1925.....	676.4	395.5	331.0	114.5	191.1	26.7	10.0	71.7	41.4	78.6	104.7	729.9	9.2
1926.....	831.0	407.1	324.7	160.8	220.8	23.3	10.2	74.9	36.5	71.4	110.9	819.6	10.3
1927.....	878.4	479.7	335.0	116.7	239.2	33.5	15.4	76.9	42.1	56.6	96.7	749.0	11.9
1928.....	902.2	533.6	293.3	160.8	307.4	27.0	14.7	99.2	50.7	103.3	115.5	859.8	11.0
1929.....	773.9	.....	317.6	.....	.....	....	....	70.8	37.4	96.9	91.9	.....	11.5
Average													
1909–13.....	690.1	197.1	351.8	90.5	147.1	20.1	6.5[a]	71.5	37.8	62.0	158.7[a]	758.9[b]	11.5[a]
1923–27.....	809.5	403.7	344.7	136.3	218.0	27.2	11.5	68.6	34.8	65.1	97.0	638.0	11.1

Year	Morocco	Algeria	Tunis	Egypt	British Isles	France	Germany	Italy	Belgium	Netherlands	Denmark	Norway	Sweden
1920.....	17.9	16.2	5.2	31.7	56.8	236.9	82.6	141.3	10.3	6.0	7.4	1.00	10.3
1921.....	23.2	28.5	9.0	37.0	73.8	323.5	107.8	194.1	14.5	8.6	11.1	.97	12.3
1922.....	12.9	18.9	3.7	36.0	65.2	243.3	71.9	161.6	10.6	6.2	9.2	.64	9.5
1923.....	20.0	35.8	9.9	40.7	58.5	275.6	106.4	224.8	13.4	6.2	8.9	.59	11.0
1924.....	28.8	17.3	5.2	34.2	53.9	281.2	89.2	170.1	13.0	4.7	5.9	.49	6.8
1925.....	23.9	32.7	11.8	36.2	53.7	330.8	118.2	240.8	14.5	5.6	9.7	.49	13.4
1926.....	16.2	23.6	13.0	37.2	52.2	231.8	95.4	220.6	12.8	5.5	8.8	.59	12.2
1927.....	24.6	28.3	8.3	44.3	57.2	276.1	120.5	195.8	16.3	6.2	9.4	.60	16.2
1928.....	24.7	30.3	12.1	37.3	50.9	277.7	141.6	228.6	18.0	7.3	12.1	.68	19.5
1929.....	28.6	40.6	12.1	....	41.8[c]	....	110.0[d]	238.8	16.0	3.8	....	....	....
Average													
1909–13.....	17.0	35.2	6.2	34.2	59.6	325.6	131.3	184.4	15.2	5.0	6.3	.31	8.1
1923–27.....	22.7	27.5	9.6	38.5	55.1	279.1	106.0	210.5	14.0	5.6	8.5	.55	11.9

Year	Spain	Portugal	Switzerland	Austria	Czecho-Slovakia	Poland	Finland	Latvia	Esthonia, Lithuania	Greece	Japan, Chosen	South Africa	New Zealand
1920.....	138.6	10.4	3.6	5.4	26.4	22.7	.27	.39	2.58	11.2	41.1	7.6	6.9
1921.....	145.1	9.3	3.8	6.5	38.7	37.4	.58	.78	3.34	10.3	39.7	8.7	10.6
1922.....	125.5	10.0	2.6	7.4	33.6	42.4	.71	.96	4.17	9.0	39.8	6.3	8.4
1923.....	157.1	13.2	3.8	8.9	36.2	49.7	.69	1.64	3.70	8.8	35.2	6.0	4.2
1924.....	121.8	8.6	3.1	8.5	32.2	32.5	.79	1.58	3.86	7.7	35.3	7.1	5.4
1925.....	162.6	12.1	3.5	10.7	39.3	57.8	.93	2.16	6.08	11.2	40.0	9.2	4.6
1926.....	146.6	8.6	4.2	9.4	34.1	47.1	.92	1.86	5.02	12.4	40.7	8.0	8.0
1927.....	144.8	11.4	4.1	12.0	40.4	54.2	1.06	2.64	6.35	13.0	40.1	6.6	9.5
1928.....	122.6	6.6	4.3	12.9	51.5	59.2	.88	2.50	7.36	15.7	41.3	6.9	8.4
1929.....	139.8	....	5.8	11.6[d]	....	64.7	.96	....	....	16.8	41.1	...	...
Average													
1909–13.....	130.4	11.8[e]	3.3	12.8	37.9	63.7	.14	1.48	3.63	16.3[e]	32.0	6.3[a]	6.9
1923–27.....	146.6	10.8	3.8	9.9	36.5	48.3	.88	1.98	5.00	10.6	38.3	7.4	6.3

* Data of U.S. Department of Agriculture and International Institute of Agriculture. For 1909–13, including U.S. Department of Agriculture estimates for area within post-war boundaries. Dots (....) indicate that data are not available.

[a] Four-year average.

[b] Regarded as too low by some Soviet officials, whose estimate is 908 million bushels.

[c] England and Wales only.

[d] Winter wheat only.

[e] One year only.

TABLE II.—MONTHLY WHEAT RECEIPTS AT PRIMARY MARKETS IN THE UNITED STATES AND CANADA*

(*Million bushels*)

Month	United States primary markets				Fort William and Port Arthur				Vancouver			
	1925–26	1926–27	1927–28	1928–29	1925–26	1926–27	1927–28	1928–29	1925–26	1926–27	1927–28	1928–29
Aug.	43.3	71.6	81.6	84.2	1.2	1.5	2.4	3.5	.55	.12	.09	1.07
Sept.	57.9	48.7	79.7	73.3	45.7	32.8	8.6	39.1	.28	.29	.32	2.61
Oct.	36.1	37.1	73.3	84.4	53.2	56.1	51.4	81.4	7.04	6.37	6.17	12.69
Nov.	34.1	29.8	44.8	43.6	51.5	60.5	71.0	72.9	9.79	7.22	10.78	14.65
Aug.–Nov.	171.4	187.2	279.4	285.5	151.6	150.9	133.4	196.9	17.66	14.00	17.36	31.02
Dec.	34.9	22.4	26.5	33.0	53.5	26.3	41.0	51.6	6.14	6.63	11.81	13.53
Jan.	21.6	24.6	23.5	22.5	10.5	14.0	21.1	11.0	10.03	6.83	16.49	13.90
Feb.	16.2	21.0	22.5	28.7	4.0	8.6	9.5	2.9	7.74	4.27	12.54	9.25
Mar.	15.1	16.6	26.3	27.2	3.2	6.3	3.3	5.2	6.98	5.94	10.50	15.46
Dec.–Mar.	87.8	84.6	98.8	111.4	71.2	55.2	74.9	70.7	30.89	23.67	51.34	52.14
Apr.	14.0	14.4	18.0	17.5	1.8	12.6	.9	9.7	3.58	3.58	10.88	7.31
May	15.7	19.2	25.9	18.6	17.2	17.3	17.6	13.8	1.20	1.56	7.43	3.91
June	21.0	20.7	15.6	25.7	13.6	7.3	20.1	14.7	.22	.61	3.66	3.04
July	77.0	58.8	72.6	....	6.4	10.7	14.4	14.6	.27	.14	2.44	3.30
Apr.–July	127.7	113.1	132.1	....	39.0	47.9	53.0	52.8	5.27	5.89	24.41	17.56
Aug.–July	386.9	384.9	510.3	....	261.8	254.0	261.3	320.4	53.82	43.56	93.11	100.72

* United States data are unofficial figures compiled from *Survey of Current Business;* Canadian data are official figures from *Reports on the Grain Trade of Canada* and *Canadian Grain Statistics.* Vancouver figures include receipts at Prince Rupert after October 1, 1926.

TABLE III.—WEEKLY WHEAT RECEIPTS AT PRIMARY MARKETS IN THE UNITED STATES AND CANADA*

(*Million bushels*)

Month	United States				Fort William and Port Arthur				Vancouver			
	1926	1927	1928	1929	1926	1927	1928	1929	1926	1927[a]	1928[a]	1929[a]
Apr.	2.61	3.78	5.48	5.35	.51	.83	.48	1.59	1.19	1.15	2.78	3.06
	3.27	3.49	4.42	4.86	.68	.64	.23	1.50	1.10	1.27	1.96	2.69
	2.79	2.98	4.48	4.12	.52	.59	.26	1.17	.93	.54	2.77	2.00
	3.52	3.41	4.17	3.55	.29	4.34	.26	.51	.69	.77	2.92	1.37
	3.75	3.38	4.07	3.66	.18	6.86	.09	4.80	.86	.94	2.81	1.41
May	3.51	3.60	4.86	3.84	2.17	6.42	.25	4.10	.56	.34	2.41	1.47
	3.09	3.89	6.70	4.03	4.00	3.87	3.13	3.11	.35	.14	1.95	1.09
	3.60	5.20	7.46	4.08	4.75	2.96	6.56	3.54	.22	.49	1.45	.74
	4.83	4.92	4.83	4.16	5.13	2.82	4.72	2.51	.07	.50	1.39	.58
June	3.68	4.93	4.32	4.56	4.89	2.49	4.22	2.43	.06	.23	1.56	.77
	3.71	4.09	3.87	5.45	2.81	1.99	4.54	2.60	.04	.11	.72	.66
	3.51	4.03	3.10	5.67	2.94	1.48	5.08	3.32	.04	.17	1.21	.49
	5.67	4.15	2.89	6.30	2.74	1.33	4.38	4.16	.08	.18	.64	.67
July	8.80	7.65	4.24	7.51	1.95	1.33	4.93	4.46	.05	.06	.46	.98
	13.79	8.54	7.40	11.45	2.04	2.07	4.28	3.25	.10	.07	.69	.75
	14.25	10.35	14.24	16.49	1.63	2.89	3.14	3.61	.06	.04	.50	.57
	19.26	11.35	18.76	17.84	1.19	3.10	3.07	3.42	.01	.02	.46	.85
	25.25	26.01	23.93	29.69	.92	2.61	3.03	2.89	.05	.00	.72	1.00

* United States data are unofficial figures compiled from *Grain World;* Fort William and Port Arthur data are official figures for *net* receipts furnished by Canadian Board of Grain Commissioners; Vancouver data are official figures compiled from *Canadian Grain Statistics.* United States and Fort William and Port Arthur data begin with figures for weeks ending April 3, 1926, April 2, 1927, March 31, 1928, and March 30, 1929; Vancouver figures are for weeks ending one day earlier.

[a] Receipts at Prince Rupert included.

Table IV.—International Trade in Wheat and Flour, Monthly from July 1928*

(Million bushels)

A.—Net Exports

Month	United States	Canada	India	Australia	Argentina	Roumania	Hungary	Jugo-Slavia	Poland	Algeria	Tunis	Egypt
July	5.13	35.92	1.19[a]	5.02	9.56	.04	.62	.17	(1.41)[b]	.58	.96	(.44)[b]
Aug.	13.94	29.18	.51[a]	4.43	6.51	.36	2.46	2.96	(.53)[b]	.70	1.05	(.74)[b]
Sept.	21.25	30.89	.25[a]	2.79	8.29	.29	2.38	2.03	(.53)[b]	.74	.78	(.73)[b]
Oct.	26.65	48.89	.05	4.55	12.00	.47	2.32	.58	(.20)[b]	.42	.56	(.75)[b]
Nov.	13.62	80.56	(1.36)[b]	5.93	12.73	.18	2.14	.22	(.13)[b]	.47	.41	(1.10)[b]
Dec.	10.97	53.22	(1.29)[b]	8.39	38.27	.09	2.44	.06	(.20)[b]	.45	.25	(1.37)[b]
Jan.	6.70	24.93	(6.50)[b]	18.66		.08	1.58	.03	(.18)[b]	...		(1.60)[b]
Feb.	7.18	19.19	(5.18)[b]	16.68	27.25	.09	1.55	.01	(.18)[b]	...	.15	(1.50)[b]
Mar.	7.90	27.37	(3.88)[b]	16.12	29.63	.01	2.14	.15	(.09)[b]	...	.07	(1.70)[b]
Apr.	7.73	10.43	(3.16)[b]	11.67	25.36	...[c]	2.45	.78	(.09)[b]	...	.12	(1.28)[b]
May	14.55	31.05	(1.64)[b]	7.89	23.27	...	2.04	....	(.11)[b]	...	....	(1.15)[b]
June	7.98	29.76	(.76)[b]	.....	23.02	...	1.95	....	(.09)[b]	(.04)[b]	.57	(.86)[b]
July	12.56	20.73	.....	.....	15.04	...	....	....	....	...	....	....

B.—Net Imports

Month	Irish Free St.	United Kingdom	France	Germany	Belgium	Italy	Netherlands	Scandinavia	Switzerland	Czecho-Slovakia	Baltic States[d]	Japan
July	1.37	19.36	3.26	6.96	3.68	8.57	1.71	1.78	1.41	1.33	.64	.63[a]
Aug.	1.42	16.44	4.41	6.67	3.73	5.33	2.25	2.67	1.12	1.57	.88	.45[a]
Sept.	1.77	14.17	5.13	7.71	3.95	5.56	3.52	2.87	1.24	1.88	.90	.43[a]
Oct.	2.09	13.44	4.31	7.15	3.39	7.44	2.52	2.55	1.50	2.52	1.31	.85
Nov.	.73	15.92	3.83	4.99	3.79	7.21	2.55	2.85	1.14	1.73	1.17	.64
Dec.	1.57	20.54	3.47	4.54	3.65	7.09	2.54	3.16	1.69	1.36	.81	1.40
Jan.	1.44	18.13	3.92	4.43	2.89	6.96	2.80	2.78	1.30	1.25	.87	1.96
Feb.	1.59	14.14	2.51	2.18	2.90	5.94	1.69	1.71	.46	.94	.73	2.57
Mar.	1.43	18.14	3.48	3.02	3.13	8.88	2.55	2.34	.84	1.10	.63	2.87
Apr.	1.66	19.98	4.97	9.00	3.08	8.57	2.14	4.45	1.97	1.54	.72	2.14
May	1.45	18.96	5.64	6.05	4.20	9.67	2.29	3.59	1.55	1.16	.64[e]	2.35
June	1.48	15.13	6.55	5.88	3.34	8.10	2.53	2.71	1.28	1.14	.77[e]	1.28
July	....	15.85	....	....	....	....	....	....	....	....	....	....

* Data from official sources and International Institute of Agriculture.

[a] Gross, not net.

[b] Net import.

[c] Net export of 4,700 bushels.

[d] Finland, Esthonia, Latvia.

[e] Excluding Latvia.

TABLE V.—WEEKLY WHEAT AND FLOUR SHIPMENTS BY AREAS OF ORIGIN AND DESTINATION, APRIL–JULY 1929*

(*Million bushels*)

Week ending	North America	Argentina, Uruguay	Australia	Russia	Danube	India	Other countries	Total	To Europe	To ex-Europe
Apr. 6	6.21	5.93	3.15	...	.02	...	.65	15.96	11.42	4.54
13	7.80	5.94	2.84	...	.06	...	.86	17.50	13.03	4.47
20	5.62	5.21	3.92	...	.01	...	.74	15.50	9.45	6.05
27	7.59	4.15	2.32	...	...	...	.58	14.64	9.74	4.90
May 4	6.59	4.27	2.66	...	...	...	.51	14.03	10.00	4.03
11	7.18	6.22	1.86	...	.25	...	.62	16.13	13.56	2.57
18	8.03	6.50	1.65	...	.12	...	.77	17.07	13.77	3.30
25	10.47	6.67	1.80	...	.02	...	.64	19.60	16.67	2.93
June 1	9.65	3.65	.50	...	...	...	.74	14.54	12.44	2.10
8	10.73	6.12	2.26	...	...	...	.53	19.64	15.47	4.17
15	9.38	5.97	1.63	...	...	...	.63	17.61	14.06	3.55
22	8.95	4.80	1.39	...	.03	...	.67	15.84	12.41	3.43
29	6.44	6.09	.69	...	...	...	.56	13.78	10.84	2.94
July 6	8.67	5.33	1.55	...	.12	.10[a]	.68	16.45	13.18	3.27
13	7.82	4.31	1.18	...	...	.06	.66	14.03	10.16	3.87
20	7.99	2.99	1.16	...	.12	...	.51	12.77	9.52	3.25
27	7.48	2.39	1.27	...	.01	.04	.50	11.69	8.25	3.44
Aug. 3	6.89	2.62	.59	...	.21	.01	.57	10.89	8.47	2.42

* Here converted from data in Broomhall's *Corn Trade News*. Broomhall's weekly figures do not always check with his cumulative totals, which presumably include later revisions. Shipments from "other countries" apparently include a part of the shipments from the Danube and Russia in most weeks.

[a] Australian re-shipped.

TABLE VI.—WEEKLY VISIBLE SUPPLIES OF WHEAT IN NORTH AMERICA, UNITED KINGDOM PORTS, AND AFLOAT TO EUROPE, APRIL–JULY 1929*

(*Million bushels*)

Date	United States	Canada	U.K. ports	Afloat to Europe	Total	Date	United States	Canada	U.K. ports	Afloat to Europe	Total
Apr. 6	127.7	187.2	7.0	69.6	616.5	June 1	100.0	139.9	9.4	59.8	309.1
13	126.2	184.3	8.0	65.3	383.8	8	97.9	133.5	8.4	65.2	305.0
20	123.0	171.9	8.2	60.5	363.6	15	96.6	124.4	7.6	61.9	290.5
27	119.3	165.7	8.5	58.7	352.2	22	95.1	119.4	8.6	58.3	281.4
						29	95.7	117.4	10.1	53.2	276.4
May 4	116.6	161.0	9.6	55.2	342.4	July 6	99.3	113.1	6.6	53.3	272.3
11	112.1	158.7	9.4	53.8	334.0	13	105.5	110.5	6.7	48.9	271.6
18	107.2	153.4	10.0	53.7	324.3	20	111.3	108.9	6.1	46.1	272.4
25	102.1	147.2	8.8	60.4	318.5	27	125.4	107.4	6.0	42.5	281.3

* United States data are *Bradstreet's;* Canadian data from *Canadian Grain Statistics;* United Kingdom and Afloat data from Broomhall's *Corn Trade News* and *Milling*. Canadian figures are for the days preceding the dates indicated in the above table, and include stocks in some elevators for the preceding week, but are adjusted to bring stocks in western country elevators to the correct week.

TABLE VII.—WORLD VISIBLE WHEAT SUPPLIES, AUGUST 1, 1920–29, AND MONTHLY, 1928–29*

(*Million bushels*)

Date	United States	Canada	Argentina	Australia	United Kingdom ports	Afloat to Europe	North America	Argentina, Australia	U.K. and afloat	Grand total	Total ex-Australia
1920 Aug. 1	42.7	8.2	3.7	27.5	12.8	76.2	50.9	31.2	89.0	171.1	143.6
1921 Aug. 1	56.2	8.9	3.7	30.0	7.6	57.9	65.1	33.7	65.5	164.3	134.3
1922 Aug. 1	43.1	19.3	2.2	3.0	7.1	48.9	62.4	5.2	56.0	123.6	120.6
1923 Aug. 1	73.3	14.1	4.4	18.0	8.2	39.0	87.4	22.4	47.2	157.0	139.0
1924 Aug. 1	72.1	31.6	6.8	30.0	9.9	41.8	103.7	36.8	51.7	192.2	162.2
1925 Aug. 1	57.3	23.4	7.7	8.4	9.2	33.3	80.7	16.1	42.5	139.3	130.9
1926 Aug. 1	64.2	28.3	4.1	6.2	4.3	38.6	92.5	10.3	42.9	145.7	139.5
1927 Aug. 1	65.9	42.7	5.9	12.7	7.8	46.1	108.6	18.6	53.9	181.1	168.3
1928 Aug. 1	88.1	69.2	5.9	9.5	10.1	44.7	157.3	15.4	54.8	227.5	218.0
Sept. 1	135.9	30.5	8.5	5.2	9.5	43.7	166.4	13.7	53.2	233.3	228.1
Oct. 1	181.3	76.5	7.3	3.4	7.8	41.1	258.3	10.7	48.9	317.9	314.5
Nov. 1	204.4	155.1	7.3	1.3	5.9	50.3	359.5	8.6	56.2	424.3	423.0
Dec. 1	208.0	169.5	4.4	8.0	5.7	63.5	377.5	12.4	69.2	459.1	451.1
1929 Jan. 1	204.7	218.6	5.9	75.0	6.2	54.4	423.3	80.9	60.6	564.8	489.8
Feb. 1	186.7	208.2	10.3	76.5	6.5	64.8	394.9	86.8	71.3	553.0	476.5
Mar. 1	179.8	195.2	12.8	63.0	5.8	70.1	375.0	75.8	75.9	526.7	463.7
Apr. 1	173.1	177.1	14.7	53.0	8.0	71.0	350.2	67.7	79.0	496.9	443.9
May 1	165.4	158.3	14.3	48.0	9.6	55.2	323.7	62.3	64.8	450.8	402.8
June 1	136.7	137.9	14.0	39.0	9.8	59.8	274.6	53.0	69.6	397.2	358.2
July 1	131.9	112.5	15.4	30.0	8.2	53.2	244.4	45.4	61.4	351.2	321.2
Aug. 1	190.3	99.8	16.2	20.0	6.2	37.6	290.1	36.2	43.8	370.1	350.1
Average, Aug. 1											
1910–14	58.8	10.8	1.3	5.9[a]	15.4	35.2	69.6	7.2[a]	50.6	127.4[a]	121.5
1924–28	69.5	39.0	6.1	13.4	8.3	40.9	108.5	19.5	49.2	177.2	163.8

* A joint compilation by Broomhall, the *Daily Market Record*, Minneapolis, and the *Daily Trade Bulletin*, Chicago, here summarized from Broomhall's *Corn Trade News* and the *Daily Trade Bulletin*. Includes some flour stocks.

[a] For Australia, 4-year average, 1911–14.

TABLE VIII.—UNITED STATES AND CANADIAN CARRYOVERS OF WHEAT, 1919–29*

(*Thousand bushels*)

Year	United States (July 1)				Canada (August 31, 1919–23; July 31, 1924–29)				
	Total	On farms	In country mills and elevators	Commercial visible (Bradstreet's)	Total	On farms	In elevators	In transit	In flour mills
1919	49,806	19,261	19,672	10,873	.....[a]	2,149	3,305	.....[a]	.....[a]
1920	110,254	49,546	37,304	23,404	.....[a]	2,122	6,930	.....[a]	238
1921	93,840	56,707	27,167	9,966	13,727	2,144	4,831	6,032	720
1922	81,457	32,359	28,756	20,342	20,590	2,360	11,024	4,578	2,628
1923	102,414	35,894	37,117	29,403	11,690	1,441	5,051	2,758	2,440
1924	106,204	30,981	36,626	38,597	45,159[b]	7,363[c]	27,400[b]	5,856[b]	4,539[b]
1925	86,447	29,357	25,287	31,803	26,483	2,709	17,939	3,835	2,000
1926	65,949	20,973	28,490	16,486	35,601	3,987	25,451	3,163	3,000
1927	74,507	27,215	21,776	25,516	50,586	4,264	37,079	5,243	4,000
1928	84,514	23,729	18,856	42,208	76,484	4,186	53,570	13,728	5,000
1929	180,561	44,741	40,136	95,684	104,426	5,617	82,640	8,669	7,500
Average									
1910–14	89,411	32,485	31,600	25,326	.....[a]	.....[a]	.....[a]	.....[a]	.....[a]
1924–28	83,524	26,395	26,207	30,922	46,863	4,502	32,288	6,365	3,708

*Bradstreet's visible, and official data of U.S. Department of Agriculture and Dominion Bureau of Statistics. See especially *Agriculture Yearbooks*, *Canada Yearbooks*, *Grain World*, and press releases.

[a] Not available.

[b] July 31, as for later years.

[c] For 1924 quantities in farmers' hands relate to August 31; for subsequent years to July 31.

TABLE IX.—WEEKLY CASH PRICES OF REPRESENTATIVE WHEATS IN LEADING EXPORTING AND IMPORTING MARKETS, APRIL–JULY 1929*

(*U.S. dollars per bushel*)

Month	United States				Canada		Argentina	Liverpool				
	No. 2 Red Winter (St. Louis)	No. 2 Hard Winter (Kansas City)	No. 1 Northern Spring (Minneapolis)	No. 2 Amber Durum (Minneapolis)	No. 1 Manitoba (Winnipeg)	No. 3 Manitoba (Winnipeg)	Barletta (Buenos Aires)	No. 1 Manitoba	No. 3 Manitoba	Pacific White	Argentine Rosafe	Australian
Apr.	1.30	1.10	1.20	....	1.23	1.16	1.12	n.q.	1.39	1.36	1.30	1.37
	1.30	1.14	1.21	1.18	1.25	1.17	1.12	n.q.	1.39	1.36	1.26	1.37
	1.28	1.13	1.22	....	1.24	1.15	1.11	n.q.	1.40	1.35	1.26	1.40
	1.22	1.07	1.18	1.19	1.21	1.13	1.09	n.q.	1.34	1.31	1.21	1.36
May	1.18	1.07	1.18	1.12	1.21	1.13	1.08	n.q.	1.33	1.32	1.19	1.35
	1.22	1.04	1.14	1.13	1.12	1.05	1.03	n.q.	1.29	1.30	1.20	1.30
	1.18	1.03	1.13	1.09	1.14	1.07	1.04	1.36	1.25	1.26	1.17	1.29
	1.16	1.00	1.11	1.14	1.14	1.07	1.02	1.36	1.26	1.26	1.19	1.30
	1.10	.94	1.05	1.02	1.08	1.02	.98	1.32	1.23	1.24	1.12	1.25
June	1.11	.98	1.07	1.14	1.16	1.11	1.00	n.q.	1.26	1.21	1.14	1.24
	1.21	1.02	1.12	1.25	1.15	1.10	.99	n.q.	1.25	1.26	1.13	1.26
	1.21	1.02	1.14	1.09	1.18	1.12	1.00	1.32	1.26	1.24	1.14	1.25
	1.27	1.09	1.22	1.12	1.26	1.19	1.05	1.44	1.36	1.30	1.20	1.30
July	1.23	1.13	1.29	1.16	1.41	1.33	1.14	n.q.	1.40	n.q.	1.29	1.36
	1.24	1.17	1.32	1.23	1.46	1.38	1.17	1.59	1.54	n.q.	1.34	1.41
	1.43	1.30	1.50	1.46	1.69	1.61	1.27	1.83	1.73	1.52	1.48	1.50
	1.41	1.29	1.49	1.44	1.74	1.66	....	1.91	1.77	1.55	1.47	1.58
Aug.	1.40	1.31	1.50	1.44	1.72	1.66	....	n.q.	1.87	1.54	1.49	1.60

*United States prices are weekly averages of daily weighted prices for weeks ending Friday, compiled from *Crops and Markets*. Canadian prices are averages for weeks ending Saturday, compiled from *Canadian Grain Statistics*. Liverpool prices are for Tuesday of the same week, parcels to Liverpool or London, and are from Broomhall's *Corn Trade News*. Argentine prices are averages for weeks ending Saturday, from *Revista Semanal*. No quotation is signified by "n.q."

TABLE X.—MONTHLY PRICES OF DOMESTIC WHEAT IN EUROPE, FROM AUGUST 1926*

(*U.S. dollars per bushel*)

Month	Great Britain			France (Chartres)			Italy (Milan)			Germany (Berlin)		
	1926–27	1927–28	1928–29	1926–27	1927–28	1928–29	1926–27	1927–28	1928–29	1926–27	1927–28	1928–29
Aug.	1.76	1.63	1.33	1.61	1.75	1.60	1.85	1.75[a]	1.72	1.75	1.78[b]	1.49
Sept.	1.46	1.43	1.19	1.77	1.57	1.58	2.03	1.73	1.81	1.71	1.68	1.36
Oct.	1.48	1.37	1.24	1.88	1.54	1.61	2.21	1.77	1.88	1.72	1.62	1.38
Nov.	1.62	1.32	1.28	1.96	1.48	1.60	2.20	1.90	1.87	1.78	1.57	1.37
Dec.	1.55	1.29	1.25	1.78	1.58	1.56	2.31	1.88	1.87	1.74	1.53	1.33
Jan.	1.55	1.29	1.25	1.88	1.58	1.59	2.13	1.93	1.92	1.72	1.52	1.35
Feb.	1.54	1.26	1.27	1.81	1.56	1.64	2.11	1.94	1.96	1.72	1.49	1.40
Mar.	1.52	1.27	1.27	1.70	1.65	1.68	2.11	2.00	1.95	1.73	1.59	1.44
Apr.	1.50	1.34	1.28	1.82	1.74	1.60	2.02	2.09	1.93	1.76	1.72	1.45
May	1.58	1.43	1.29	1.91	1.87	1.65	2.16	2.14	1.89	1.92	1.73	1.41
June	1.65	1.43	1.25	1.88	1.85	1.60	1.99	2.10	1.91[a]	1.96[c]	1.66	1.39
July	1.64	1.41	1.35	1.81	1.76	1.63[a]	1.80	1.77	1.80[d]	n.q.	1.60	1.56[d]

*Data for Great Britain are averages of weekly average *Gazette* prices as given in the *Economist;* for France, averages of Saturday prices furnished directly by Federal Reserve Board, and our French correspondent, M. Augé-Laribé; for Italy, averages of Friday prices of soft wheat as given in *International Crop Report and Agricultural Statistics;* for Germany, monthly average prices as given in *Wirtschaft und Statistik,* except for July 1929 which is an average of Friday prices as given in *International Crop Report and Agricultural Statistics.* All data are converted, for convenience, from the domestic currency in which they are quoted in the above sources into U.S. money by monthly average exchange rates. No quotation is signified by "n.q."

[a] Three-week average.
[b] Second half of August.
[c] First half of June.
[d] Two-week average.

TABLE XI.—APPROXIMATE DISPOSITION OF WHEAT SUPPLIES IN FOUR LEADING EXPORTING COUNTRIES, 1924–25 TO 1928–29*

(Million bushels)

Item	United States (July–June)					Canada (August–July)				
	1924–25	1925–26	1926–27	1927–28	1928–29	1924–25	1925–26	1926–27	1927–28	1928–29
Initial stocks	165	135	111	138	142	41	26	35	48	78
New crop	864	676	831	878	902	262	395	407	480	534
Total supplies	1,029	811	942	1,016	1,044	303	421	442	528	612
Net exports	258	95	209	194	147	192	324	292	332	406
Seed requirements	84	83	89	95	88	38	40	39	42	45
Consumed for food	479	492	492	505	507	42	42	43	42	44
Unmerchantable, lost in cleaning, fed on farms	73	30	14	80	40	22	18	31	34	44
Apparent error in crop estimate						—17	—38	—11	...	—31
Stocks at end	135	111	138	142	262	26	35	48	78	104
Total disappearance	1,029	811	942	1,016	1,044	303	421	442	528	612

Item	Argentina (August–July)					Australia (August–July)				
	1924–25	1925–26	1926–27	1927–28	1928–29	1924–25	1925–26	1926–27	1927–28	1928–29
Initial stocks	66	56	61	65	80	38	36	30	41	40
New crop	191	191	221	239	307	165	115	161	117	161
Total supplies	257	247	282	304	387	203	151	191	158	201
Net exports	123	94	143	178	221	124	77	103	70	108
Seed requirements	23	25	24	25	23	11	11	12	14	14
Consumed for food	53	54	57	59	61	29	29	30	30	31
Feed and waste	2	10	3	3	4	3	4	5	4	5
Apparent error in crop estimate	...	+3	—10	—41	—22	...	...	...	...	...
Stocks at end	56	61	65	80	100	36	30	41	40	43
Total disappearance	257	247	282	304	387	203	151	191	158	201

*Based so far as possible upon official estimates for the various items of supply and disposition. Estimates for 1928–29 are preliminary. For detailed explanation of our method of estimation and adjustment of items in the disposition table, see notes in WHEAT STUDIES, V, 111 f.

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